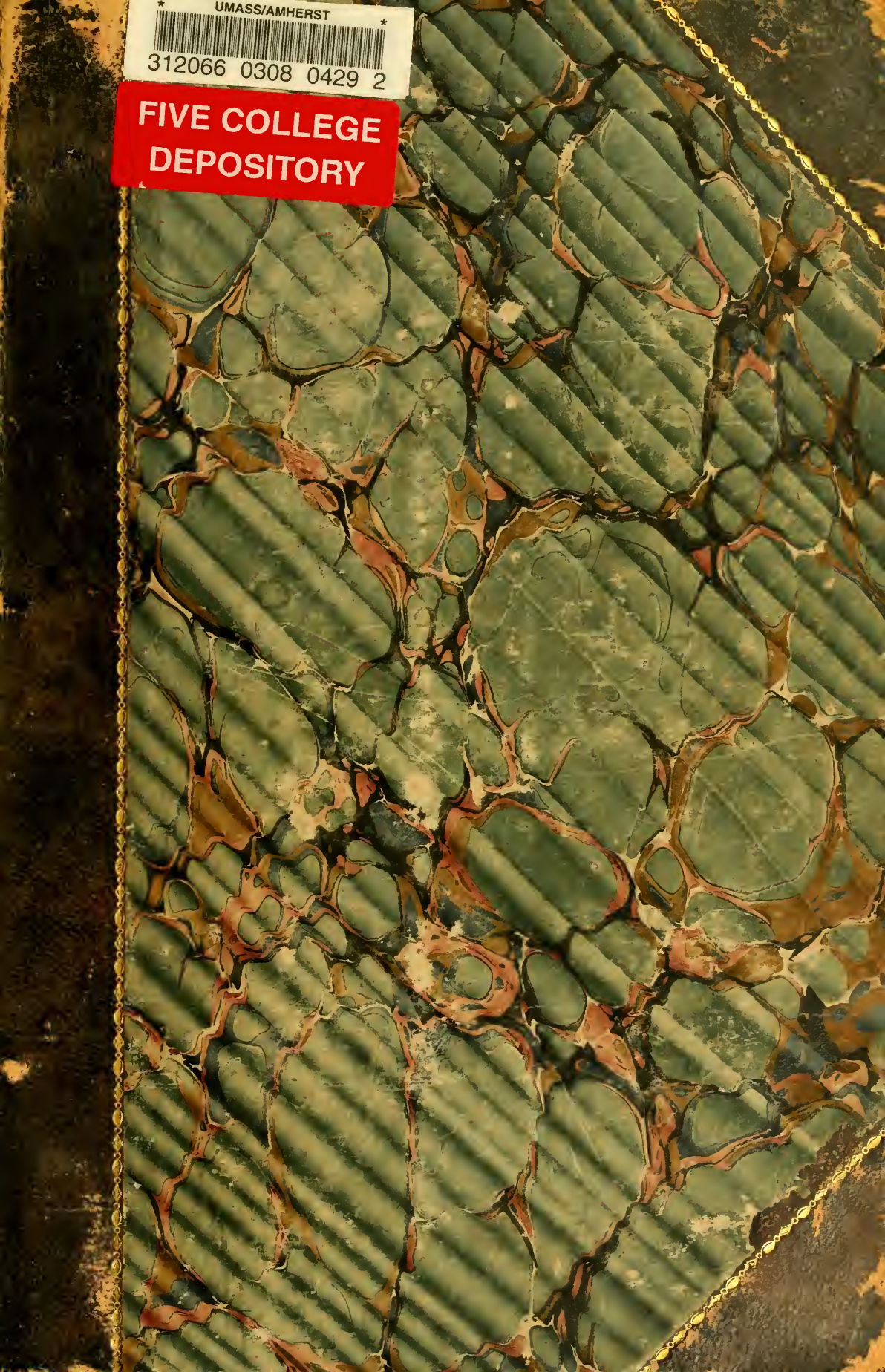
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THE

FARMERS' REGISTER:

A MONTHLY PUBLICATION,

DEVOTED TO THE

IMPROVEMENT OF THE PRACTICE,

AND

SUPPORT OF THE INTERESTS

OF

AGRICULTURE.

And he gave it for his opinion, "that whoever could make two ears of corn, or two blades of grass, to grow upon a spot of ground where only one grew before, would deserve better of mankind, and do more essential service to his country, than the whole race of politicians put together." *Swift.*

EDMUND RUFFIN, EDITOR AND PROPRIETOR.

VOL. X.—1842.

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1842.

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DIRECTIONS FOR THE BINDER.

The sheets containing the 'Essay on Calcareous Manures,' forming parts of Nos. 7, 8, 9, 10, 11 and 12, of this volume as issued, should be collected together, and, with the first and last sheets of the Essay, not yet printed, form the No. 12, of vol. x, Farmers' Register.

The concluding sheets of 'The Westover Manuscripts,' issued as parts of the first few numbers of vol. x., with the preceding portion of that publication, should be placed together in binding at the close of vol. ix.

THE FARMERS' REGISTER.

VOL. X. JANUARY 31, 1842. No. 1.

EDMUND RUFFIN, EDITOR AND PROPRIETOR.

THE BOARD OF AGRICULTURE, AND ITS DESIGNED ACTION.

A bill has passed the House of Delegates, but still remains undecided upon by the Senate, to pay for the personal expenses of the members of the Board of Agriculture, while the Board is actually in session, $3 per day, and the same rate of mileage pay, for travelling to and from the place of meeting, as is allowed to members of the Assembly. Even if this bill should pass the Senate, it will furnish nothing towards paying for the actual necessary outlay of money by members, in other, and as necessary expenditures; nor even for the smallest and most indispensable expenses of the Board itself, in stationary, clerkship, printing, &c. It is hoped however that even the continued existence of a great deficiency in this respect will not prevent the members performing the duty imposed on them, though the greater part of their expenditures, as well as their labor, may be at their own cost. But it will be absolutely necessary that at least the poor compensation proposed by the bill now before the Senate shall be given, or otherwise it is very certain that the law instituting the Board had as well be repealed *directly*, as in this indirect manner. However willing the members of the Board may be to make considerable sacrifices for the public benefit, it would be folly to expect of those the most remote, who have to travel more than 800 miles merely to attend and return from the annual meeting of the Board, can continue to do so at their own cost entirely. The editor, though a member of the Board, may be free to speak thus, because, being within 20 miles of Richmond, the mileage pay to him would be scarcely worth consideration. And the *per diem* pay (which for this first year would be but $18 for each one,) can scarcely be supposed to have much influence on his action, or that of any other member. If his own measure of pecuniary compensation were only in view, he would prefer that the services were to be, as under the original law, *altogether gratuitously rendered*. It is for other considerations, necessarily involving the very existence of the Board of Agriculture, and all the hoped for usefulness to be derived from even so imperfect a plan, that the bill before the Senate is to him of the slightest importance.

It may then be understood that the proposed action of the Board of Agriculture, as submitted to the legislature, (and published in the last No. of the Farmers' Register, p. 688,) is dependent upon the enactment of the bill before the Senate, or some other not less operative legal provisions. In case of such enactment, a circular letter of inquiry from the Board will speedily be printed, together with the plan of operations, and sent to sundry of the farmers of every county, whose public spirit it is hoped may induce their furnishing their aid to the great object of collecting and diffusing agricultural knowledge.

In pursuance of the general plan, (which the readers of this publication already have had before them,) the editor, as a member of the Board, as soon as *permitted*, will commence his share of the labors of personal examination and inquiry through some counties of the southern portion of the tide-water region of Virginia, which district has been assigned to his general supervision, by the arrangement and division of labors of the Board. It would greatly facilitate such labors of personal inquiry and examination, if, in advance, something were done by some of the farmers of each county (desiring such action) in preparatory operations. The preparation might be *individual* and *separate*, in noting observations on and answers to the published heads of inquiry—and also, *general* and *combined*, in founding an agricultural society, to meet the views and aid the operations of the Board of Agriculture. Where there is so much more to be done than any one member can possibly perform, (even if possessing far more ability and leisure,) of course the editor cannot count on being able to do more than point out a course of operations to others, and aid their more useful and instructive investigations. But so far as it is possible, he will be ready to meet the requisitions of the persons and communities which may appear to be the most ready to act effectually, and who may desire, and shall signify their desire, to have his personal co-operation. Such invitations are by no means desired as mere matter of compliment, or as evidences that the visits of the member of the Board on a tour of inspection would be *welcome*, and kindly received. No doubt on the latter head would be entertained by any one acquainted with old Virginia. But as a means of properly directing the few and feeble efforts which he may be enabled to make, the member will be aided much by any such positive *indications* of the places where those efforts

are most desired, and will be most certainly aided, and thereby rendered effective.

As was stated before, the constitution of a *working* agricultural society submitted at page 719, of last volume, if the general plan be approved, and whether amended or taken entire, may save much trouble in commencing and organizing societies. And at the time of such organization, or other designated time of meeting afterwards, it may be most beneficial to the cause that the visiting member shall then attend in pursuance of his mission; and it will be his pleasure, as well as duty, so to do, so far as the performance may be in his power. Though not authorized to speak in this respect but for himself, he presumes that the same remarks will apply generally to all his fellow members of the Board of Agriculture in regard to the duties assumed by them.—Ed. F. R.

MAIDSTONE FARMERS' CLUB.

Dr. Robinson concluded his course of lectures on chemistry as applied to agriculture, on Thursday evening. The concluding lecture proved, as we anticipated, of very great interest, as it embraced the testing of some of the fashionable artificial manures, the analysis of soils, &c. Those of our readers who had not the good fortune to be present will doubtless like to acquire a knowledge of some of the simple means used by Dr. Robinson to detect adulteration, more particularly as these require no previous knowledge of chemistry to enable any farmer to apply them. The lecturer's mode of testing nitrate of soda was the following. This salt is sometimes adulterated by a mixture of perhaps one-fourth of common salt (chloride of sodium,) which may be purchased at about one-fourth the price, and which it so closely resembles as to render it difficult to protect the admixture without some chemical process. Nitrate of soda, when pure, burns, if thrown on the fire or a pan of live coals, something like saltpetre. If it be adulterated with salt, however, it burns with a sharp cracking noise, which is greater or less in proportion to the quantity of common salt used, and the combustion is imperfect. Dr. Robinson observed that common salt was actually prejudicial to some soils, but even if it were not, there was no good reason why the farmer should give the same price for it as for nitrate of soda. Another test, which belonged rather to the higher branches of chemistry, was the following. Take a brachin of nitrate of silver (lunar caustic) and dissolve it in half an ounce of rain water. Dissolve a tea-spoonful of the suspected nitrate of soda also in rain water. Mix these two solutions together, and if a white curdly precipitate is observed to form, common salt is present. In this case the precipitate (chloride of silver) is insoluble in the acids, but would be soluble in strong ammonia. Nitrate of soda was also sometimes adulterated with sub-carbonate of soda, which can be obtained at about half the price. The mode of detecting this mixture is by dissolving some of the suspected crystals in rain water, and adding a little strong sulphuric acid (oil of vitriol.) If sub-carbonate of soda be present, effervescence will ensue. With reference to bone-dust, Dr. Robinson said that this was very frequently adulterated with wood dust and other substances, when sold in a very fine state. A simple mode of detecting the presence of saw-dust was by burning a portion of the manure, the bone would not burn, whilst the particles of wood, if present, would sparkle and burn. The farmers of Lincolnshire, partly from the fear of adulteration, and partly from bone-dust when ground too fine passing away too quickly, would never buy bone-dust when ground very fine. Dr. Robinson tested some adulterated bone-dust on some burning coals, and the coruscations of the saw-dust were clearly perceptible. He then applied the same test to some bone-dust which had been obtained from the Lenham mills, which was, however, found to be perfectly pure. Another test was the following. Bone-dust, when reduced to a fine powder, was perfectly soluble in hydrochloric acid (spirits of salt,) diluted with three times its bulk in rain water. Twelve hours were required for this experiment, at the end of which, if pure, the bone-dust would be completely dissolved. The lecturer produced a sample of the *guano*, recently introduced into this country from South America. It was the excrement of the flamingo and other birds which feed on fish, and which contained all the properties required in a fertilizer. It could be supplied at about 28*l.* a ton, and was drilled in with the crop in the same manner as bone-dust. This, if it came into extensive demand, would also most assuredly be subject to adulteration, which, however, would be very easily detected; for the guano, if pure, is readily and completely dissolved in diluted sulphuric acid. Dr. Robinson next proceeded to notice the mode of analyzing soils, which subject, however, we have only room to mention. It is almost needless to add that this course of useful, practical, and valuble lectures has given great satisfaction, and much information, to the members of the Maidstone Farmers' Club.

CROP OF CORN-STALKS.

From the American Farmer.

Permit me to mention an experiment made by myself at Washington, on the subject of fodder.—Noticing the statement made in the French periodicals, that the stalks of corn (maize) contained one half as much saccharine matter as cane, and knowing that my ancestors made their molasses during the revolutionary war from these stalks, I sowed four and a half bushels of common corn, broadcast, and harrowed in the same. This labor was easily performed by a single man with a team (including the ploughing) in a day. Having soaked the corn in saltpetre water, it took a rapid start, overtopped the weeds, and covered the ground with a forest of stalks. When fairly tasselled, I cut the same, which I fed to cattle, horses and hogs, both green and dry. If fed to swine after being cured, it was cut and fermented with chop

or bran. Being anxious to ascertain the quantity, I measured a few square feet of the stoutest. I found I had 5 lbs. of green fodder per square foot; this may not seem credible, and it is probably less than what would grow in rich lands at the west; if, however, we consider there are 43 560 square feet in an acre, we shall obtain 217,800 lbs., equal to 108½ tons of green fodder!

I cut the first crop the early part of July, and ploughed and sowed the same land again, and took a second crop two thirds as large, and even tried a third on the same land, but it did not reach over ten inches before the frost seized it. Persons who have only a small patch of ground may try this experiment to advantage and fill their barns with fodder.

In curing stalks, it is recommended to place the small end upon the ground, with the buts upward, to guard against the absorption of moisture from the wet ground. Whoever will try the experiment of cutting flowers, and putting some on damp flannel, or into water, and hanging up others in the sun, will see the advantage of curing fodder in the way I have mentioned. Should any fear the stalks would not stand upon the small end, a few rows could be left to support the remainder.—*Hon. H. L. Ellsworth.*

REPORT ON ORCHARDS.

From the New England Farmer.

The committee appointed by the trustees of the Society for the promotion of Agriculture in Massachusetts, consisting of Messrs. Welles, Prescott, Phinney, Codman and Quincy, having by their chairman examined the orchard of Capt. George Randall, report—

That it appears said orchard was set out in April, 1837. Its extent was about 3½ acres. The soil was good, but rather light, and was in a good state of preparation for the trees. The ground has been since annually cultivated for a crop; the benefit of which, both in the thrift and production of an orchard, seems generally agreed in. The number of trees was 212: their distance apart, 25 feet. There was a doubt with the committee whether the distance might not have been advantageously enlarged even to 35 or 40 feet. In four years they had acquired, several of them, near the roots, about thirteen inches in circumference, and at three feet above the ground, eleven inches by measurement. Many of the trees had extended in the growth of the limbs during the past season, from 15 to nearly 30 inches.

Mr. Randall's communication contains an account of a wash of oil soap, &c., which has been used by him on the trees in this orchard, since they were set out. If this application should operate to prevent the ravages of the borer, it will be of most important utility, as this depredator, with the canker worm, seems to threaten the very existence of our orchards. All which is well and fully set forth in the communication above alluded to, which your committee recommend should be forthwith published. And the committee further recommend that the premium of fifty dollars be awarded and paid to Capt. George Randall, for the best orchard.

All which is respectfully submitted by order of the committee, JOHN WELLS, *Chairman.*

New Bedford, 17th Aug., 1841.

To Benj. Guild, esq., Boston:—sir—I have a young apple orchard in the town of Rochester, Plymouth county, Mass., and ten miles from this place, which I wish to offer for a premium; *and do, by this letter*, offer, or apply for the premium, for the best orchard in the commonwealth, that has been planted out *four years* from the nursery.

Respectfully, your ob't. ser't.

GEORGE RANDALL.

The following comprises Mr. Randall's useful observations:

Description.

The extent of the orchard, 3½ acres; the number of trees, 212; their distance apart, 25 feet; the names of the apples or varieties, 57—as follows: Mela Carla; Flushing Spitzenberg; lady; doctor; English russet; Knight's pippin; crow's egg: Pumwater sweeting; red and green summer pearmain; pear apple; Amory; red doctor; Ruggles' sweeting; French nonpareil; Peck's pleasant; Gravenstein; black gellyflowers; Dawson; Dyre; Coney; Prince's Harriet; summer russet; orange sweeting; R. I. greening; superior sweeting (from the garden of the Hon. Jas. D'Wolfe, Bristol, R. I.); Æsopus Spitzenberg; blue pearmain; Mawney sweeting; Newton Spitzenberg; no core; yellow bellflower; Tewksbury winter blush; Wurner, (from Canaan, N. Y.); summer greening; codling; Porter; Roxbury russett; marigold; Hubbardston's nonsuch; Cooper; seek-no farther; summer sour; Ben; John goodwin; green Newton pippin; Pennock red winter; summer rose; Catlin; Baldwin; fall sarine; bellflower; winter sweeting; honey greening; lily pippin; early sweet bough; nonesuch.

Treatment.

The ground has been planted to roots, every year since, and including 1837, viz.: to potatoes, carrots, ruta baga, sugar beets and mangel wurtzel.

The manures used have been common stable; compost of stable, loam and swamp mud; lime compost, spent ashes, plaster, and a small quantity of saltpetre.

The trunks and lower limbs of the trees have been well washed with oil soap, sand and water, every spring and fall since they were planted out; after which a coat of oil soap has been put on with a painter's brush. The oil soap is made by refining and bleaching sperm oil, and is composed of from 33⅓ to 35 per cent. potash, and the balance sperm oil and impurities from the oil.

The first pruning was done the first of May last past; at which time every tree had the earth removed from around it, to examine for borers, not one tree was found to contain a borer, or any indication of one.

The soil, a sandy gravelly loam, and naturally light.

Observations.

I have noticed that shallow planting with all trees succeeds much the best, and can, I think, be accounted for philosophically. The roots are luxuriating in a good soil, and are more immediately under solar influence.

My mode of planting is as follows:—The mutilated roots of each tree are carefully cut off smooth;

even the small fibrous ones, and engrafting salve but over large cuts. The roots are immersed in water for above one half hour before planting, thereby inducing the mould or loam to become attached to them. The hole to be dug sufficiently large so that every root may extend without bending or being cramped. I put nothing around the roots but surface earth, and that carefully worked in by hand, each root and fibre thus laying horizontally and naturally. I use no manure in setting. One bushel of fine stable manure was put round each tree the first of November, and repeated for two years.

I prefer raising the earth around trees when first planted, above the common level, and thereby give them firmness, than to plant deep, placing a tree deeper than it originally stood, with no prospect of finding the surface earth, thus becoming a moss-covered and stinted tree, whose roots have been searching a cold and uncongenial soil, with little or nothing to give them vitality.

As to the time for planting, from the little experience I have had, I much prefer the spring of the year.

Much has been said and written in favor of autumnal planting. It may be that English authors have done much to encourage this opinion. In Old England I should expect them to succeed well in fall planting: they have but a few degrees of frost compared with New England.

In answer to your inquiries as to the oil soap, I say that from 8 to 10 lbs. of oil soap are put into a common pail, we put on a sufficient quantity of warm water, so that when commingled with the soap, it is about as thick or a little thicker than paint when mixed for use. With this pail of soap, thinned as described, the man having a small tin pail, or bag, or pocket, filled with fine sand, tied round his waist, with a coarse crash cloth and a paint brush, is ready for operating. He first wets his cloth with soap, then scatters on some dry sand, and gives the trunk and branches a good rubbing, after which, with a paint brush, he puts on a coat of the soap, prepared as above, equal to a thick coat of paint. It is well to select for this work the termination of a storm of rain, when the moss, or any roughness on the bark, will yield more readily to rubbing.

Respectfully, your ob't. serv't.

GEO. RANDALL.

The preceding useful observations were in part made in Mr. Randall's first application to the Secretary, Mr. Guild, for premium, and afterwards enlarged by the request of the committee.

EXHIBITION OF GRAPES TO THE LONDON HORTICULTURAL SOCIETY.

From the London Gardeners' Chronicle.

At an ordinary meeting in Regent street, Sept. 17th, we find the following report in relation to several grapes which were then exhibited:—

Mr. Roberts sent specimens of six different varieties of grapes, grown on young vines two years planted; and certainly for size, and weight of the bunches, we should think they have never been surpassed: a large silver medal was awarded them. The kinds were Cannon Hall Muscat; one bunch weighed 2 lbs. 3 oz., and some of the berries measured 1½ inch in circumference: an extraordinary bunch of the white Nice, which weighed 7 lbs. 12 oz., was not quite ripe, and from its usually being brought to the table in that state, it is little esteemed; when, however, it is well ripened, its berries assume an amber tint, and become high flavored: black Hamburg, black Prince, black Damascus, and black Morocco; a bunch of the first weighing 2 lbs. 5 oz.; of the second, 2 lbs. 15 oz.; of the third, 1 lb. 11 oz.; and of the fourth, 2 lbs. 7 oz. Mr. Stewart had a Banksian certificate given him for his black Hamburg grapes, and a seedling with small round berries. Mr. R. Buck sent a bunch of Cannon Hall Muscat, which weighed 1 lb. 11 oz. The grapes from Mr. Roberts were as fine specimens of cultivation as are ever seen near London, but his Hamburgs wanted color; this defect was avoided in Mr. Stewart's, whose black grapes were as jetty as they ever can be in the brightest and most sunny season. A bunch of Muscat of Alexandria, from A. Brooke, Esq., weighed 1 lb. 12 oz., and was in perfect maturity: a Banksian certificate was awarded for it.

THE IMPORTANCE OF ALKALIES IN SOILS.

To the Editor of the Farmers' Register.

Prospect Hill, Ky., Jan. 1, 1842.

The following quotation is from Liebig's late work on organic chemistry. "A soil, which has been exposed for centuries to all the influences which effect the disintegration of rocks, but from which the alkalies have not been removed, will be able to afford the means of nourishment to those vegetables which require alkalies for their growth, during many years; but it must gradually become exhausted, unless those alkalies which have been removed are again replaced; a period will therefore arrive, when it will be necessary to expose it from time to time to further disintegration, in order to obtain a new supply of soluble alkalies. For small as is the quantity of alkali which plants require, it is nevertheless quite indispensable for their perfect developement. But when one or more years have elapsed, without any alkalies having been extracted from the soil, a new harvest may be expected."

"The first colonists of Virginia found a country the soil of which was similar to that mentioned above; harvests of wheat and tobacco were obtained for a century, from one and the same field, without the aid of manure, but now whole districts are converted into unfruitful pasture land, which, without manure, produces neither wheat nor tobacco. From every acre of this land there were removed, in the space of one hundred years, 1200 pounds of alkalies in leaves, grain, and straw; it became unfruitful, therefore, because it was deprived of every particle of alkali, which had been reduced to a soluble state, and because that which was rendered soluble again, in the space of one year, was not sufficient to satisfy the demands of the plants. Almost all the cultivated land in Europe is in this condition; fallow is the term applied to land left at rest for further disintegration. It is the greatest possible mistake to suppose that the temporary diminution of fertility, in a soil, is owing to the loss of humus; it is the mere consequence of the exhaustion of the alkalies."—p. 195-6.

Although the facts stated in the latter paragraph of the above quotation may not be entirely correct, yet it is worthy of inquiry whether the diminution in the fertility of the lands of lower Virginia may not, in a considerable degree, have been caused by the exhaustion of the alkalies, which existed in the soil, at the time it was first brought into cultivation.

According to Liebig, "the developement of a plant requires the presence, first, of substances containing carbon, and nitrogen, and capable of yielding these elements to the growing organism; secondly, of water and its elements; and, lastly, of a soil to furnish the *inorganic* matters, which are likewise essential to vegetable life."—p. 56. Water is composed of hydrogen and oxygen, and as plants are capable of decomposing and assimilating its elements, (pp. 122 and 125,) there can never be a deficiency in the supply of these to growing vegetation, except in time of drought. During the early growth of plants, carbon is furnished by the humus of the soil, in which they grow, but after they have developed their leaves an abundant supply of carbon is obtained from the atmosphere, by means of their absorbing power. This supply is so great, that in the opinion of Liebig, (p. 106,) they no longer acquire any from the soil, and return even that which they had extracted, during the formation of their first leaves. The remaining *organic* substance, essential to the growth of plants, is nitrogen. This, according to Liebig, is furnished, to some extent, from the atmosphere, in the form of carbonate of ammonia. This substance is very soluble in water, and consequently combines with the moisture of the atmosphere, and is brought down to the earth with the dews, rain and snow, and thus furnishes, to some extent, this necessary element for the nourishment of plants. The quantity derived in this way, though considerable, is not sufficiently ample to produce a flourishing and vigorous growth of plants. To preserve the fertility and productiveness of soils, the *deficiency of nitrogen* must be supplied by the application of putrescent manures, which abound in this ingredient. According to Liebig, this may be so easily effected, that by the application of human excrements, "using, at the same time, bones and the lixiviated ashes of wood, the excrements of animals might be completely dispensed with."—p. 242.

From these views it is quite apparent, that but little effort is necessary to prevent our growing crops from suffering from a deficiency in the principal *organic elements*, which constitute the appropriate food of plants.

But several *inorganic matters* "are likewise essential to vegetable life." Liebig informs us that "most plants, perhaps all of them, contain organic acids of very different composition and properties, all of which are in combination with *bases*, such as *potash*, *soda*, *lime*, or *magnesia*. These *bases* evidently *regulate* the formation of the acids, for a diminution of the one is followed by a decrease of the other."—(p. 148.) Here are four of the *inorganic* substances which are most essential to the growth of vegetables. They are, it is true, combined with *organic* acids, which are necessary to fit them for assimilation, but the quantity of the acid is always regulated by the *base*, so that, if the latter be diminished, the former will be decreased in a corresponding degree; and whenever a *base* is present the acid will be supplied. We have then but to furnish the soil with potash, soda, lime, and magnesia, (if they do not already exist,) when the necessary acids, to fit them for assimilation by the growing plants, will combine with them.

The inorganic substances, mentioned above, are all important in constituting a good soil, but magnesia is, perhaps, less so than either of the others; yet even this is essential to the vigorous growth of many vegetables, for, as we are told by Liebig, "all seeds of the *graminœ* contain phosphate of magnesia," (p. 93,) and that without this substance "the seeds of corn (wheat) could not be formed."—p. 201.

Many soils are, by nature, abundantly supplied with carbonate of lime. But when it does not exist, in soils, it is very important that it should be supplied. Fortunately, the extensive banks of shell marl, in lower Virginia, afford the means of doing so, and no reasonable expense should be spared in accomplishing an object so important in the renovation of exhausted soils.

Vegetables of all kinds contain, in their composition, more or less of the alkalies. It is very clear, therefore, that this ingredient is indispensably necessary to their growth. If a soil has been entirely exhausted of the alkalies, it must necessarily be completely barren. If it has been only partially exhausted, it will be still capable of producing a vigorous growth of those trees and plants which require only a small supply of the alkalies. But the growth of those which require a large supply must necessarily be much stinted. Thus forest trees, the leaves of which are renewed annually, require from six to ten times more alkalies than the pine or fir tree, and hence pines will grow vigorously in a soil, where other trees cannot attain maturity. (p. 198.) So 100 parts of wheat straw will yield of ashes 15.5 parts, whilst that of barley yields 8.54, and of oats only 4.42.—p. 199.

Plants of the *leguminosæ* family require very small quantities of the alkalies. Buckwheat, beans, lucerne, clover, and lentils yield less than one per cent. of ashes.—p. 204.

These facts are abundantly sufficient to show that the quantity of alkalies, in soils, should be in proportion to the kind of crops intended to be produced. If they exist only sparingly, those crops should be avoided which require a large supply, unless the soil should have been furnished by artificial means. Wheat requires not only more of the alkalies than any other crop, but also a considerable quantity of the phosphates, and is therefore a very exhausting crop.—p. 205.

The alkalies being so necessary to constitute a good soil, the question arises how this ingredient is to be supplied to those soils, from which it has been nearly all extracted. This is to be accomplished first by ceasing to cultivate those crops, which require a large supply of the alkalies; and secondly, by furnishing by artificial means, those soils which are deficient, with a due proportion of these essential ingredients.

Soils are supplied with alkalies, in the natural way, first, by the disintegration of rocks, (p. 195-6) and secondly, by water evaporated from the sea, and falling in the form of rain, snow and dew (p. 160 166-7.) But the supply from these sources is too slow and gradual to be relied upon exclusively, and therefore great efforts should be

made to increase the quantity by the application of ashes. Lixiviated ashes are valuable, as they contain silicate of potash and salts of phosphoric acid, (p. 228); but those which have not been lixiviated are much more so. Both kinds are so highly esteemed, as manures, in Germany, that they are transmitted to the distance of twenty-four miles. In situations, which admit of water or rail-road transportation, they might be carried to still greater distances, with decided advantage.

It is not very material whether potash or soda is furnished to soils, from which the alkalies have been extracted, for these *bases* are readily substituted for each other, where there is a deficiency of either, (p. 149.) Potash may even be substituted, in many cases, not only by soda, but also by lime and magnesia, (p. 200.) This shows what a powerful effort is made by nature to supply plants with alkalies, by substituting alkaline earths, where they are entirely deficient.

I have heretofore adverted to the high estimate formed by Liebig, as to the value of human excrements as a manure. Of these urine is by far the most valuable part. Urine contains several ingredients, which are extracted from the ashes of wood, such as *sulphate* of potash and soda, and *phosphate* of soda. It contains also phosphates of ammonia, magnesia and lime, and several other valuable ingredients for the nourishment of plants. Liebig estimates 100 parts of the urine of a healthy man to be equal to 1300 parts of the fresh dung of a horse, (p. 240.) The saving and application of this manure is, therefore, of very great importance. But if not properly taken care of it is subject to great loss. During putrefaction, carbonate of ammonia is formed, which volatilizes, and passes off in the form of gas, and the urine becomes alkaline. In this way nearly one half of the urine is lost, (p. 237.) Liebig informs us that the carbonate of ammonia, formed during putrefaction, may be converted into a salt, and thus fixed in the soil. This may be effected by strewing a field with gypsum, and then sprinkling it with urine. It may also be neutralized and converted into a salt, which has no volatility, by the chloride of calcium, sulphuric or muriatic acid; or super-sulphate of lime, (p. 238.) As the value of this manure will be so greatly increased, by preventing the ammonia from escaping, which is formed during the putrefactive process, this should never be neglected.

Yours, truly, A. Beatty.

TO KEEP SKIPPERS FROM BACON.

It is stated in the "Plough Boy," an agricultural paper recently commenced in South Carolina, that if a small piece of sulphur is thrown on the fire every day the bacon is smoking, it will effectually prevent skippers and bugs from entering. We consider this an important matter, and we are strongly disposed to believe the remedy a good one.—*Ex. paper.*

The remedy may be, and no doubt is, a good one, but we doubt its propriety, believing that the fumes of the brimstone will impart a bad flavor to the bacon.—Ed. Ky. Far.

[If the remedy be effective in preventing skippers, no fear need be entertained of a disagreeable odor remaining. We have heard that as good effect may be produced by throwing a few pods of red pepper on the fire once in two or three days during the smoking of the bacon. The latter plan has been tried several years in our own house-keeping; and whether that or some other cause operated, there were no skippers in the bacon. In one case, salted fish in barrels, placed in the meat-house after the smoking was finished, was full of skippers, while the bacon remained free.—Ed. F. R.]

PAPERS ON CHEAT AND SPELT, OR DARNEL.

[In our recent remarks on spelt, we had to refer to the following articles from memory alone, not having seen them since soon after their first publication, and having lost our volume of the American Farmer containing them. Our friend, Dr. G. B. Smith, the then editor of that work, has since kindly supplied the lost volume; and from it we copy below the whole correspondence which brought out the before published facts in regard to darnel, and its recent introduction into this country. It should be observed, that the writing of the first of these articles, was induced by a preceding long discussion in the American Farmer on the convertibility of wheat to cheat.—Ed. F. R.]

Prince George Co., Va., June 6, 1832.

Mr. Smith.—Notwithstanding all the facts and arguments that have been brought forward in the controversy on the origin of cheat, that has lately occupied your columns, it is highly probable that the writers on both sides, and their readers, without an exception, retain the same opinions as at first. We are always too partial to the reasons that support our side of any question, to allow fair play to those on the other; and thence it follows, that when the reasons are strong, yet vulnerable on both sides, no amount of authority, or extension of argument, can convert partizans, or establish the truth. Believing it, therefore, utterly useless, I shall abstain from adducing the reasons that have satisfied my mind that cheat is not the product of degenerated or damaged wheat. But however ineffectual argument may be, a few experiments, made and observed carefully, will serve to decide this interesting and important controversy; and I invite your correspondents, and others who feel interested in the decision, to aid in this mode of obtaining it. Perhaps more satisfactory experiments than the one I shall propose, may be thought of by others; but this alone will suffice to prove that wheat may be changed to cheat, if indeed that opinion is correct.

Select a soil supposed to be the most favorable to the production of cheat. This I consider to be on some sandy slope, which is subject to be too wet in winter and spring. Let a small space, (now clear of growing cheat) be broken up and stirred at different times, from August to October,

so as to cause every seed in the soil to sprout, and then to be destroyed. At the time of sowing wheat, mark off a square of ten or twelve feet accurately into checks of a certain size, (say eight inches,) and at every crossing of the lines plant three grains of imperfect wheat. The grains should be dropped together in a hole made by thrusting a small stick to the proper depth. In the spring, let the plants be cut or grazed once or oftener, but not so late as to prevent the formation of seed stalks. All the causes that are severally supposed to produce cheat would here operate; and if any stalks of cheat should be produced, their situation and number would clearly show whether they sprung from the grains of wheat or not.

Being entirely ignorant of botany, I am not sure that all of us refer to the same plant when we speak of cheat. That name here is sometimes made to include the two very different plants, which will accompany this letter; though one of them (marked No. 2) is now generally distinguished by the name of spelt. The latter is by far the worst pest of the two—and though now less abundant, is, like the cheat, (No. 1,) increasing in spite of all the means yet used for its destruction—and both together threaten the most serious injury to the wheat-grower. The general opinion is, that both these plants are produced from wheat, by the operation of some of the various causes that have been urged by your correspondents who believe in such transformations. But no reasons have been offered, why wheat should sometimes change to cheat, and sometimes to spelt—nor why neither should have been sufficiently plenty twenty or twenty-five years ago, to be a noticeable evil in our crops, though our cultivation then was even more slovenly than it is at this time. The grains of cheat being considerably smaller, and specifically lighter than wheat, may be mostly got out of a crop by good fanning and losing much good wheat with it. But the grains of spelt are so nearly of the same size and weight with those of wheat, that it is impossible to separate them by either the fan or the screen.

Whenever our negligence has permitted cheat and spelt to be scattered over our farms, it seems almost impossible to stop their growth, even to those farmers who suppose that they never are produced except from parent plants of the same kind. The purchase of pure seed wheat (which is already extremely difficult) does not remedy the evil, as the seeds of both cheat and spelt will often remain uninjured a year, or perhaps much longer, without germinating, when buried deep by the plough. But with those who believe that wheat changes to cheat and spelt, it is obviously *impossible* to get rid of the evil; and that opinion is calculated to repress every effort for that purpose. Hence the necessity of deciding by fair and careful experiments, whether these pests are legitimate or bastard vegetable products. E. R.

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Remarks on the above, by the Editor of American Farmer.

The specimens enclosed in the above communication were, *a head of cheat*, (*Bromus secalinus*,) and *a head of darnel*, (*Lolium temulentum.*) The latter is the first specimen we have seen of the plant, and were not before aware of its having made its way across the Atlantic. It is the plant which the English farmers suppose originates from wheat. We have also found a specimen of *Bromus mollis*, soft brome grass, which some suppose originates from timothy. It resembles cheat very much, except that it is more delicate, with smaller heads and seeds. It is somewhat curious that this timothy cheat, as it is called, (soft brome grass) was found in a wheat field, where there never had been a spear of timothy.

Apropos. A farmer who is a firm believer in the degeneracy of wheat to cheat, informed us that he saw a whole field of cheat, and that the owner was cutting it for hay. It proved to be a fine crop of rye grass—*Lolium perenne.*

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Poplar Grove, June 30, 1832.

Mr. Smith:—I herein enclose you two heads of darnel or cheat, the one with a head resembling oats, is that kind which has been known in this section of the country, time immemorial—the other is a plant which from its peculiar form of growth, resembling the teeth of a saw or notches on a board, has acquired the name of the *notch* darnel. It first appeared on Kent Island, soon after the British encampment on that Island, during the late war, from whence it has been carried by birds, and has spread considerably elsewhere. It has a larger and heavier grain than the common darnel, and hence it is with more difficulty separated from the wheat in winnowing. How far its more farinaceous character renders it a better food for stock than the old darnel, I know not. Like the Hessian fly which soon appeared after the encampment of the British on Long Island, it is believed to have been introduced by them; but whether with more truth or not, I am unable to say. I should be glad, if you can furnish them, to have the true botanical names of both these plants, and also the vulgar names they are known by in England; where I presume they are both known, and where the latter may probably be in cultivation for some edible purpose, as I believe it to be extremely productive.* It has long been a matter of surprise to me that intelligent farmers, and particularly my highly intelligent friend Muse, should believe that wheat is capable of turning to darnel. It is against the order of nature, and I venture to assert, it will be against all *fair* experiments to produce the change. It cannot, in my opinion, be in the power of man or beast to effect it. If you sow *wheat on a clean soil*, you will have wheat, and if you sow darnel you will have darnel, without any danger of its *turning back*, to the end of time. A sound rule ought to work both ways; but you can no more convert darnel into wheat, than wheat into darnel.

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T. Emory.

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By the Editor of American Farmer.

We are much indebted to Col. Emory, of the Eastern Shore, of Maryland, for the communi-

* Is it German speltz, tares or vetches, neither of which plants, although grown and known in Europe, I have any knowledge of? The samples I send are unripe.

cation on another page relative to cheat. The "heads of darnel" enclosed in the letter, are those of common cheat, and the darnel of the English. Cheat, in England is called smooth rye; in America, cheat, chess, and sometimes darnel. Its botanical name is *Bromus secalinus*, belonging to the 3d class and 2d order of Linnæus. But there is another species of bromus or cheat very common in this country, and so nearly resembling common cheat that it is often mistaken for it. It is the *Bromus mollis* of Linnæus—soft brome grass of the English. The only material difference between this plant and the true cheat, is the slenderness of its growth and smallness of its seeds, by which, when together, the two species are easily distinguished. The soft brome grass is supposed to spring from degenerated timothy, by the believers in such changes, as it is most usually found in grounds adapted to timothy.

Darnel, the kind mentioned by Col. Emory, as having first appeared in Kent Island, (in the Chesapeake bay) soon after the British encampment on that island, of which Col. E. sent a specimen, is the *Lolium temulentum* of Linnæus, belonging to the 3d class and 2d order of the Linnæan arrangement. It is of the same genus as the celebrated and excellent perennial rye grass, and this latter and eight other species are all called darnel in England. Some farmers in England, and other parts of Europe, still suppose that this darnel originates from degenerated rye and wheat, whence probably the common name of rye grass.

By some persons in Virginia, the darnel (lolium temulentum) is called *spelts*, but improperly, as there is a species of wheat, *triticum spelta*, which is called *spelt* in England; but no other plant is called by any name resembling it. Spelt is grown in some parts of Germany, on high land, where common wheat will not ripen. It is improperly placed in the genus triticum, (wheat,) as it has distinct generic characters. It has a stout straw, almost solid, with strong spikes or heads, and chaff adhering firmly to the grain. The grain is light, yields but little flour, and makes poor bread.

The tares or vetches of England, are very distinct plants from cheat and darnel. They are the *Vicia sativa* of Linnæus, and in their characters and habits resemble the common pea.

We rejoice that Col. Emory has been able to trace the origin of this new pest, (darnel,) as otherwise our wheat would have been degraded by another suspicion of its mutability. It has, however, already suffered in this way, as will have been seen in an article in the 16th number of the Farmer, page 134. The origin of darnel having been traced to Kent Island, its existence there is easily accounted for:—it was doubtless brought there in the horse provender, in the oats; and as it is a common practice to feed the *tailings* of wheat to horses, it is very probable that quantities of that article were sent over for the use of the British cavalry horses, and thus left on the island where the army encamped.

We are glad to add the name of so respectable a gentleman as Col. Emory to the list of those who believe in the immutability of wheat, and of every other created thing. Vegetables may be improved in their qualities, may be rendered worthless, and may be hybridized, by high or low cultivation, and by cross impregnation, but their distinctive characters, their organic structure, must always remain the same—without a shadow of change. The short fine hair of the leaves can no more be taken from cheat nor added to wheat than a regular ear of corn can be produced upon broom corn; than watermelons can be produced from pumpkin vines, or any other such irregular operation.

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Prince George County, Va., Oct. 23, 1832.

Mr. Smith:—When I sent to you for examination a head of *darnel*, or what is here called *spelt*, I was surprised to learn from your answer that its existence in this country is so limited, as it must be, as it had not before fallen under your observation. It is a subject for congratulation, that our country generally is yet free from the worst pest that attends the cultivation of wheat. As soon as I was informed by you that our *spelt* was the English weed *darnel*, I immediately attributed its presence here, to the importation of English race-horses, which have been frequently landed at city Point in this county; and darnel was no doubt brought in their oats and litter, and by that means scattered over our country. By the way, a Spanish thistle full of burs and sharp thorns, was brought to the same place, and also to Petersburg, in the fleeces of Merino sheep; and having been permitted by neglect to spread, threatens to add another serious and endless annoyance to our farming. Though darnel has not been known here so long as twenty years, as a considerable injury to wheat, yet the opinion is already prevalent that this plant, like *cheat*, is merely degenerated wheat. These erroneous opinions are calculated to repress all vigorous efforts to root out the evil; and if darnel should be allowed to spread throughout the country, it will be impossible to get rid of it. By great care, perhaps we may relieve ourselves of these pests, if the attempt is made without more delay. Nothing will clear land already set with darnel, but carefully pulling every plant out of the crops of wheat, and sowing perfectly clean seed.

Darnel is poisonous in a very high degree. I have heard from good authority, of three several cases in this county of persons being made alarmingly ill by eating a single meal of bread made of wheat containing a large proportion of darnel. They were immediately seized with violent sickness of the stomach, convulsed limbs, &c. and it was thought by those who witnessed the effect, that nothing but the speedy use of active medicine, saved the lives of the persons so affected.

We farmers are apt to complain of the millers, for the many and strong objections that they make to the condition of our wheat when offered to them for sale,—and we complain with some reason, because such objections are urged irregularly, capriciously, and are very much influenced by the demand and price. But if some fixed and regular rule could be adopted, which would impose a heavy but uniform penalty on the farmer for every kind of impurity in his wheat, I have no doubt but it would be ultimately, if not immediately, beneficial to every farmer, as well as to the miller, and to the whole region of country in which the rule was adopted, by raising to the highest grade the character of its wheat and flour. When wheat of average quality sells for one dol-

lar the bushel, a crop free from all impurity ought to be worth ten cents more; and the foulest that would be considered "merchantable," would be worth ten cents less—making a difference of twenty cents between the best and worst quality. If prices were always proportioned to these values, the difference would be a sufficient premium for the care necessary to keep crops clean. But unfortunately such is not the case. The purchaser will readily admit that there is this great difference in the intrinsic worth of the best and worst wheat; but his prices must be regulated by his expected sales—and he cannot afford to add to the average price above five cents for the best, nor need he deduct more than the same amount from the worst. Thus the average quality of wheat in any certain market, serves in a great measure to fix, or to approximate to it, the prices of both the best and worst crops. Therefore, the most slovenly farmer gets for his wheat five cents more than its intrinsic value, and he who sells perfectly clean wheat gets five cents less. This state of things amounts to a bounty being offered for foul crops.

A remedy for this evil, and a great and rapid improvement in the general quality and cleanness of our wheat, might probably be effected by something like the following plan. Suppose the millers of some considerable wheat market, together with some of the principal farmers who usually supply them, to consult and agree upon the full value of the injury that would be caused to clean wheat, by admixtures of either cockle, garlic, cheat, darnel, &c. For example, it might be agreed that, in a sample of one pound of wheat, it should be considered that ten grains of wheat should be deducted as a fair equivalent for the presence of one grain of darnel, or for two of garlic, three of cheat or cockle, or for ten of oats or rye, besides all the impurities so found; and that a proportional deduction shall be made from the price offered for pure or clean wheat. The selection of fair samples, and the trial of them, would be troublesome, it is true; but much less so than the usual chaffering, and the frequent dissatisfaction caused by the want of fixed and certain rules.

Let us now suppose some such *tariff of filth* to be in operation, and observe its probable effect. Suppose that, without such regulations, the demand for flour would have fixed the price of wheat of middling or average quality at one dollar; and that the amount of impurities in the sample, rated as proposed, would take off ten cents from the bushel. It may be considered by many that this would reduce the market price to ninety cents. Not so: the effect would be to *raise* the market price to one dollar and ten cents, which would be obtained by the few who could offer clean wheat—and from which the seller of average wheat would still obtain one dollar, after having ten cents deducted—and the foulest crops might suffer a deduction of twenty to thirty cents. The average of all the prices would remain the same, but would be equitably proportioned to the value of each crop—and thus hold out the strongest inducements to every farmer to aid in improving the quality and character of the wheat of the country at large.

Unless most of the farmers of a particular district unite in the endeavor to root out cheat and darnel, it will scarcely be possible for any one to succeed in the attempt. Persons who have always sown clean wheat, (or at least supposed so,) cannot conceive how the seed of cheat or darnel could get upon their fields, and therefore attribute their appearance to a transformation from wheat. But, without resorting to this mode of explaining the fact, there are abundant means by which a farm may be supplied with these pests, if they are abundant in the adjacent country. From various reasons, most farmers frequently procure seed wheat by purchase—and it is already almost impossible to obtain any near this county, entirely free from both cheat and darnel. It is true that there are plenty of crops that are *called* clean—and few will deny them that character if they contain only one grain of cheat in a handful of wheat; yet that small proportion would furnish a flourishing plant of cheat for every cast of the sower, and insure a much greater proportion in the next crop. Being subject to none of the many disasters that destroy so large a proportion of the plants of wheat, the hardy cheat and darnel show an increase of quantity in every successive crop, though much the greater part of their seeds are fanned and screened from the seed wheat. But this is not all. The grains of cheat and darnel left by the fanner in the chaff, and *tail-ends* wheat, are given in feed to hogs and other stock; and from their hard and firm covering, they frequently, if not generally, pass through the animals uninjured, to grow wherever dropped. This perhaps prevents darnel being as poisonous to beasts as it is to man. Many of both these seeds are also left in the straw, and carried out with the manure made from it. If the manure is well heated by being heaped to ferment, only all the seeds in the outer parts of the heap will germinate—or the whole will, if carried out in unrotted manure. If it is ploughed in a good depth, the seeds of darnel and cheat will remain without sprouting a year, (as I have experienced,) and perhaps much longer, and grow when afterwards brought near enough to the surface. Thus, when manure containing those seeds is ploughed in for corn, the best tillage and weeding may not prevent their springing plentifully among the succeeding crops of wheat. For these and other reasons, if cheat and darnel get on any part of a farm, they will soon spread to every acre, if great care is not used to arrest their progress.

But suppose a farmer by extraordinary care and labor to eradicate these pests, and to avoid every act by which he may introduce them again. Still by various means he will be in danger of receiving other supplies. He cannot avoid visits from his neighbors' horses, oxen, and sometimes stray hogs, carrying the seed in their bowels, and bestowing them wherever they go. Nor can he avoid lending his wheat bags, and his fanner, all of which are likely, and the last is sure, to be returned with cheat or darnel, unless the contents are sown over his farm, as they are jolted homeward. Your regular borrowers of fan-mills are generally well stocked with cheat and darnel. These chances for a supply are greatly increased if a private road, for neighborhood use, passes through a farm; and still more, if a stream, subject to overflow low grounds, and which has traversed other farms above. E. R.

For the Farmers' Register.

GRASSES AND GRASS CULTURE OF FRANCE.

Mr. Editor—Here is a brief account of some of the grasses which are mostly used in France, taken from 'Le Bon Jardinier,' for the 'Farmers' Register.'

Ivraie vivace, Ray grass of England, Lolium perenne, Darnel. Of all meadow grasses, this is that which is most generally sown in France. It is very much used under the name of *Gazon Anglais*, (English turf,) to form a covering of green. In farming, the results that are obtained from it are infinitely various, on account of the climate, the soil, and other local circumstances, which is without doubt one of the causes of the great difference of opinion in regard to its merits. In general one may admit that the ray grass is not (in France particularly) a good plant for mowing. There are however exceptions; and one often sees it in low and moist meadows, from two to three feet high, vigorous, well provided with leaves, and not coming to maturity sooner than the other grasses. In such cases it should be esteemed, and may be regarded as equal to any hay that you may find. One should then partially use it in sowing similar meadows; but without these favorable circumstances the hay is bleached, and is perfectly dry, and I have seen horses refuse it, although cut when just commencing to flower. It is then as pasturage that it is desirable to use it on all lands where it cannot obtain sufficient humidity to produce good hay. On level lands, particularly on those which are rather stiff than light, it will render good service in this manner. Its precocity, its facility of recovering after severe grazing, and of shooting again and strengthening itself, although much eaten and trampled, together with the nourishing and fattening qualities of this grass, are well known by experience, and assign it a useful place among grasses. In situations and on lands that are dry and scorching, the ray grass, whether as hay or as pasturage, is but an indifferent resource; and in every case its success and its product are always proportioned to the degree of humidity of climate and of soil. In England, where for this reason its success is much more general than in France, they often form, with a mixture of ray grass and red or white clover, a meadow destined to last from two to four years and even more. If one sows a field in ray grass, the addition of these two plants in small proportion is always desirable. For pasturage, they add only the white clover; but one might add with good effect the *Tréfle fraise*, and also the *Lothier corniculé*. One hundred pounds of seed are amply sufficient for a hectare of meadow land; for grazing, twice that quantity is necessary. They sow it in February and March, or in September and October. But where a small piece of good land is cultivated, and is to be irrigated with care, it may be sown at any season of the year.

Ivraie d'Italie, Ray grass of Italy, Lolium Italicum. Switzerland and the northern part of Italy have recently furnished us this grass, which has been cultivated for some years with much success in those countries. Some regard it as a variety of the ray grass, (Lolium perenne,) others as a distinct species. This last opinion appears to me to be the most probable: the plant, although resembling our ray grass in the head, differs widely in other respects. It does not mat itself on the ground as does our variety. Its shoots and its leaves, rising up more perpendicularly, are larger and of a more bluish green, the stalks more elevated, and the flowers always bearded. The *Ivraie d'Italie* has also a disposition to put out and grow again after it has been mowed, which is altogether foreign to the other variety. They announced it as vivacious, and lasting for three or four years, but from the observations of Mons. de Dombasle, and those which I have made myself, or which have been communicated to me, it does not appear that it affords good produce for the sickle for more than two years. It is also objectionable because it is liable to the mildew and the spur. Opinion is not yet decided as to the nature of the soils to which it is best adapted, and particularly as to the power it possesses of succeeding on dry and indifferent lands. I could mention many remarkable instances of its success, but the greatest number of attempts give me reason to believe that it requires a moist soil, or at least a cool one, which must be at the same time rich. It is probable that it will be a long time before we can arrive at any definite conclusion about the habits of this plant, because it offers strange inequalities and disparities in its vegetation and its results. Some persons attribute this to a difference of varieties; already speculation has seized this idea, to offer seeds of the really good varieties of the *Ivraie d'Italie* in opposition to what are bad. I do not believe the distinction well founded; but when I have studied it by comparative attempts, I shall endeavor to make public any conclusions that I may derive from my essays. It is however certain, that, whenever the *Ivraie d'Italie* thrives and flourishes, its produce and its vigor of vegetation are truly wonderful. I have known a piece of ground sown in May to give in the same year three good mowings of hay. The rapidity of its growth prevents its being sown with the small grain crops, as it will outgrow them, and perhaps stifle them. It is therefore necessary to sow it alone in the autumn or in the spring, at the rate of from forty to fifty kilogrammes per hectare.

Panis élevé, Herbe de Guinée, Panicum altissimum, Guinea grass. The great reputation of the Guinea grass in America has long since induced attempts to be made to introduce its culture into France. These experiments however did not succeed, probably because they were made with seed of plants which came from the Caribee islands; but, since 1820, some seeds obtained from Carolina have had much better success. At Paris and at Geneva, the plants which were obtained from these seeds have withstood the severity of our ordinary winters, and some resisted the rigorous frosts of 1820, 1830, 1832. Mons. le Compte de Mosbourg has sown it with success on a lot in the environs of Cahors. The plant, although producing but few seeds, has with me for many years propagated itself, and may be looked upon as having become acclimated. In America the Guinea grass is propagated by slips, which are obtained by separating the tufts that become very large, each one affording a great number of cuttings. This method is equally practicable here. If one wishes to raise it from the seed, it is necessary to sow them about the last of April or first of May, on a bed with a southern exposure.

In June they lay the border off in rows twelve or fifteen inches apart. The second year it attains perfection, and presents a mass of stalks and leaves of an extraordinary abundance, and often more than four feet in height. It is principally used as green food for cattle and horses. The name, Guinea grass, has been improperly applied to some other plants, particularly to *Panicum virgatum* and the *Panicum coloratum*.

Paturin, Poa des Prés, Poa pratensis, Spear grass. Among the *paturins* there are many plants interesting in different respects, but especially on account of the fine quality of the forage which they afford. The variety known as the *Paturin des prés* is perhaps the most difficult to appreciate. Few grasses are so common, or present themselves under so many different aspects. You will see it dwarfish and arid on the sides of roads and ditches, and large and succulent on moist meadows, but always very precocious, and very much inclined to spread. These two peculiarities render it often more obnoxious than useful in mixtures formed by accident, and should prevent is being employed in the formation of meadows without circumspection; although its hay has the reputation of being very excellent. It will be best, perhaps, to sow it alone, or to associate it only with the fox-tail, (*Alopecurus pratensis,*) and the common paturin, in moist lands, which, although rather later, yet require to be cut about the same time; and on dry soils with the *Dactylis glomerata* and the *Avena elatior*, and a little of the *Anthoxanthum odoratum*, and some of the leguminous grasses, taking care in the last case to mow it at an early season. When sown alone, from thirty-five to forty pounds of seed per hectare are requisite.

Le Paturin commun, Poa trivialis, Pasture grass, is as common as the preceding, and grows like it on lands of very different nature, it abounds on lands that are dry, and in artificial meadows, and yet humidity is so favorable to it, that it is often found in situations so moist that they are almost aquatic. I prefer it to the *Poa de prés.* It is necessary to mow it early, because it will wither very quickly after the flowering is over. About thirty pounds of seed per hectare are sown.

Paturin comprimé, Poa compressa, Blue grass, I should not mention, but some good works have lately adopted an old error of opinion about it, in supposing it to be the bird grass, which is extolled as forage, but about which it is almost impossible to get any correct information. I have made many attempts to obtain this bird grass, and to learn precisely what it is, and the result has been to satisfy me that, if a plant ever was cultivated in Virginia under that name, that plant was not the *Paturin comprimé*, which is a small grass that grows about walls, and in very dry places, the sparse leaves and stalks of which do not at all comport with the abundance and permanence of the verdure which is attributed to the bird grass. From the imperfect description that I have received of this grass I conclude that it is an *Agrostis*, and the similarity of name induces me to believe that it is the same with the *herds-grass*, which also is an American plant.

Paturin des bois, Poa memoralis seu angustifolia. In the experiments that I have made for several years with many different kinds of grass, the *Poa des bois* has always shown with advantage. It is rather the earliest of grasses (at least of those which are cultivated) to develope its leaves in the spring. Annually in March, it presents a mass of new and vigorous verdure, whilst the sap of the most of the other species of grass has not commenced to rise. Although the leaves are short, yet they are so numerous and so nutritious that they afford a very good mowing, even on sandy and indifferent soils. The hay which it gives, in respect to its fineness, its softness, and its verdure, excels that which is obtained from almost all of the other varieties of grass. The Paturin des bois is in other respects homely, durable, and not hard to suit with a proper soil, provided it is dry and sound, for I have never found it in low and humid meadows. A remarkable peculiarity which this grass possesses is that it grows voluntarily in the woods, and will maintain itself very well in the shade of the undergrowth. It grows also with much vigor on open lands, and even on walls, where it is often found, which proves it to be of uncommon strength of constitution. Notwithstanding these good qualities, the Paturin des bois has one most serious defect, that of not covering the ground well; its shoots, although numerous, grow always perpendicularly, and do not spread over the ground as those of many other grasses, but particularly the ray grass. Despite this objection, I regard it as one of the best of our indigenous grasses, either for early pasturage, or for sowing in meadows which it is intended shall be composed of the best and most superior plants. I have also found it very well adapted to afford verdure in the thickly shaded portions of pleasure grounds, where it will thrive for many years, whilst the ray grass and other turf grasses will quickly perish. Some forty pounds of seed per hectare are requisite.

Phalaris roseau, Phalaris arundinacea. Although this plant bears the appearance of a reed, it is very different in its qualities. Its leaves, cut when young, are tender, well stored with nutriment, and furnish excellent food for cattle. The *Phalaris* grows originally only on aquatic or very humid soils, but the following example will show that it will succeed in soils of a totally different nature. Mons. Jacquement Bonnefond of Annonay, a most worthy and intelligent farmer, has described to me a plantation of the Phalaris, which he has made with complete success on a very dry and gravelly hill-side, where verdure was never before seen. He obtained in this situation with this plant, not only vegetation, but two or three small mowings of hay, which the cows ate most heartily. This experiment was made with the variety called the *petit roseau panaché*, which is cultivated in some gardens as an ornamental plant. It has been repeated with the ordinary variety with success, by Mons. Descolombier of Moulins, whose farming is ever open to useful experiments. I, also, have some of the Phalaris, which is pretty well taken in very poor chalk land, where it resisted the drought of 1832. The discovery of Mons. Jacquement might bring about interesting results in farming.

Vulpin de prés, Alopecurus pratensis, Foxtail. Almost all observers in France, in England, and in Germany, who have studied meadow grasses, agree in regarding the *Vulpin* as one of the most precious of all, on account of its precocity, and the abundance of its forage. In the crops that I have

made for the grain, I have become acquainted with its qualities, and no grass better deserves to be brought into culture. The Vulpin loves humidity. In former editions of this work I have said that it could not be cultivated with other grasses, on account of its precocity. Later observations have caused me to change my opinion on this subject. Although the head is ripe much sooner than the other grasses, yet its vegetation continues, and a long reproduction of leaves renders it green and succulent, when the ray grass, and other good varieties, are ready for the sickle. It may be sown early in the autumn, or in the spring. About forty pounds of seed per hectare are necessary.

CURE OF MANGE IN DOGS.

To the Editor of the Farmers' Register.

In the last "Southern Planter," a writer gives us a remedy for the mange in dogs. Although in common life things which are considered valueless are compared to a dog, yet the fidelity and affection of that valuable domestic animal have always made him an object of gratitude and care with man. If we should disregard his comforts, or neglect to alleviate his maladies, we should be wanting in those noble qualities in which he has set us the example.

Some years ago, when residing in the upper country, I had a very beautiful and favorite pointer. He became mangy over his whole body, and very much reduced, so that I expected to lose him. I had a friend residing in the neighborhood who owned a tan-yard. He was kind enough to take my dog for a week or ten days, and dip him in the tan-vat several times each day. He was then rubbed well with a mixture of tanner's oil and tar, and sent home. In the course of a short time the scales began to peel off, and new hair to grow out. He soon became the sleekest and prettiest animal I ever saw, and was never again affected with the disease, or even visited by vermin for a year or two. I often thought, by his playful antics, that he was conscious of his obligations, and wished to express with kindness a gratitude which he felt; but the obligations were transferred to me, for he lived to afford me many an hour of sport and many a nice dish of game.

The disease is evidently infectious, and those that are subjects of it should not be permitted to consort with those that are not.

I hope the few brief remarks above, may lead to the relief of many a valuable animal for the mutual protection and enjoyment of himself and owner. W. J. DUPUY.

P. S. In the case above related, I first resorted to the usual remedies, such as sulphur, &c., without effect.

For the Farmers' Register,

EXPERIMENT OF FATTENING HOGS.

Surry county, January 1, 1842.

For the benefit of those persons who are giving twenty and thirty dollars a pair for *genuine* Berkshire pigs, I will give the result of an experiment made on feeding a lot of half Berkshires. These hogs were a cross of the Berkshire hog and the China, than which no hog, in my opinion, will yield more meat proportional to the quantity of food consumed. I must confess that I was somewhat disappointed with the result, as the pork cost me a good deal more than I expected it to do; nevertheless, I will give a detail of the trial, and let every one judge for himself.

On the 24th October, 1840, a lot of half Berkshire pigs, just eight weeks old, was separated from other hogs when fed, but suffered to run at large in a standing pasture, which was bad enough, producing little else than broom straw and poverty grass. The corn was ground into hominy, and measured out to them daily; and they were fed in this way until the latter part of July, when for several weeks, nearly two months, I put them on half rations, as they were allowed as much apple pomace during that time as they would eat. A few squashes and pumpkins, &c., were also given them in the summer and fall. And on the 30th of November they were slaughtered, being then just fifteen months and five days old. On the following day they were weighed, and averaged 374 pounds, which, at 4 cents, (the price Kentucky pork sold for in this county this winter,) amounts to $14.96. They ate 37 bushels 1½ peck of corn each, at 60 cents per bushel = $22.42½. So it will be perceived that I sustained a loss of $7.46½ on each hog. This startled me, and it was some time before I could convince myself that there was no error in the calculation; but it was fact; there could not be a shadow of doubt about it.

Hogs can be and are raised much cheaper than those mentioned above, but under dissimilar circumstances. If a farmer provide good clover for his hogs to graze, they will consume scarcely half as much grain; or if he be surrounded by a forest of oaks, they are easily and cheaply kept on mast, and perhaps this is the cheapest way hogs can be raised in eastern Virginia.

From the foregoing experiment I am well satisfied that, so long as pork can be bought for $4 per hundred, and corn sold for 60 cents per bushel, neither the Berkshire nor any other hog can be raised with profit, when corn is to form the principal article of food. It matters not whether it be given in the form of swill, be steamed, or baked into bread, it will vary in cost but little, and ultimately prove a sinking business.

BOLLING JONES.

FOURTH REPORT OF THE AGRICULTURAL SURVEY OF MASSACHUSETTS, BY THE REV. HENRY COLMAN.

We have had the gratification of receiving, from the author, the volume under the above title which has just been published, from which we shall make sundry extracts for the present number. The report is a new evidence of the zeal and ability of the Agricultural Surveyor of Massachusetts, and of the utility of the survey. Nevertheless, we find that it is the last report that is to be expected; the legislature, in a paroxysm of "pen-

ny-wise and pound-foolish" economy, having cut short the survey, and surrendered the honorable distinction before enjoyed by the commonwealth of Massachusetts, of being the only state of the union that had established so excellent a means of promoting agricultural improvement.

Mr. Colman has been invited to take charge of the 'New Genesee Farmer,' and will conduct its editorial department.

GRASS AND HAY IN FRANKLIN COUNTY, MASSACHUSETTS.

From the Fourth Report of the Agriculture of Massachusetts. Counties of Franklin and Middlesex. By Henry Colman, Commissioner for the Agricultural Survey of the State.

Grasses.—Grass may be considered as the principal crop. In the hill towns, and what may be called the uplands, the artificial grasses are cultivated, such as clover, (*trifolium pratense.*) herds-grass or timothy, (*phleum pratense,*) and red-top, (*agrostis vulgaris.*) In general, three pecks of red-top, one of herds-grass, and four to six pounds of clover-seed are sown, when land, which has been cultivated, is laid down to grass. The land is laid down with some grain, either wheat, rye or oats; and the grass-seed is sown with the grain. Barley is scarcely grown at all in the country.

The clover predominates the first year; the herds-grass the second. The clover is nearly extinct at the end of the second year; and the red-top, intermixed with various natural grasses, which spring up spontaneously, furnishes a permanent matting to the soil. In general, not nearly enough seed, particularly of herds-grass, is sown. The consequence is, that the product is very coarse the first and second year, which it would not be, if treble the quantity of seed were sown. Several farmers in the state, whose authority is entitled to respect, practise a much more liberal mode of sowing; and find an advantage in doing it in the improved quality of the hay. The average yield the first year is from two to three tons; the second it may be estimated at two tons; and for a continuance of three years after that, in favorable seasons and locations, it may be rated at one to one and a quarter ton per year. These lands in general, are mowed once only in a season. There is an instance in Conway, of a piece of moist land lying at the side and foot of a hill, where the soil is deep, being a rich mould, resting upon a substratum inclined to clay, on which, by copious top-dressings of barn manure, the product has been kept up, and averages yearly nearly three tons to the acre. Of peat lands, I know of no considerable tracts in the county; and, as yet, no great attention has been paid to the draining, either by open or under-ground drains, of wet lands. The quantity of this kind of lands is not considerable; but such improvements, where required, would be amply compensated.

The next quality of grass lands are the alluvions on the Deerfield and the Connecticut rivers, and small patches on their tributary streams. The alluvial lands on the Connecticut are rarely over-flowed, excepting at the breaking up of winter; and they are, therefore subjected to a course of cultivation the same as other arable lands. The rotation on these lands is commonly the first year corn, or potatoes with manure; the same the second year, and the third year oats, pease and oats, rye or wheat, with grass. Where broom corn is planted, it generally follows a crop of Indian corn; and is continued often two or more years on the same land. The annual deposites made upon these lands by the flood are not of great advantage, and the fertility of the soil can by no means be kept up without manure.

The low alluvial lands on the Deerfield meadows, essentially differ from these from a circumstance already alluded to. The waters on the low Deerfield meadows are set back from the great river, and remain comparatively quiet; and in addition to this, the banks and hills bordering the Deerfield and its tributaries are more steep in general than those on the Connecticut. Much more enriching matter is thus brought down from them to the river in times of rain and freshets. These lands, therefore, annually and commonly oftener over-flowed, constituting the lowest meadows on the Deerfield river, are never ploughed. They require no manure; and being entirely alluvial and receiving the richest deposites, are of extraordinary and inexhaustible fertility. These meadows are always mowed twice; in some cases, three times; and the annual yield is generally estimated at three tons to the acre. The hay on these meadows is of a very fine quality, known there familiarly as the English bent (*agrostis alba*). It is a natural grass, and forms a fine and impervious sward.

The upland intervales on the Deerfield, are devoted to cultivation; and most of this land is seldom suffered to rest. For hay, the main dependence is upon the low flooded meadows; and those low and uneven portions, which it is difficult to reach with the plough.

An example has been given to me of the product of one of these low meadows in Deerfield containing nine acres, at a place called Old Fort.

The first crop of hay was, - -	25,325 lbs.
" second crop, - - -	15,120
	40,445 lbs.
The hay was sold and delivered as soon as cured, at nine dollars per ton,	$182 00
The fall feed, sold for - - -	4 50
	$186 50
The whole labor was performed by contract at four dollars per acre for both crops, - - - - -	36 00
Leaving a balance in favor of the land of - - - - - - - -	$150 50

The hay was considered as sold at a low rate. The same quality of hay in the following winter brought 13 dollars per ton.

The land has been estimated at one hundred dollars per acre. No manure has been put upon the ground. The produce in this case, was not more than an average crop. This yield was at the rate of 4,494 lbs. to the acre. First crop, 2,813 8-9 per acre; second crop, 1,657 7-9 lbs. per acre. This constitutes some of the best land in the meadows. There is that, however, which is deemed even more productive.

The hay from these natural meadows is exceedingly coveted by the cattle and remarkably nutritious. It consists of a very great variety of plants, but what is called the English bent (*agrostis alba*,) prevails with a slight intermixture of clover. I do not know what has given it the name of English, as it is without doubt indigenous to the soil. It requires to be cut early, otherwise it becomes hard and wiry. Some of the farmers are in the habit of making or drying this hay much less than formerly. It was considered best to dry it as much as possible; but this is not now the case. Hay, wet from external moisture, whether dew or rain, always suffers and becomes mouldy and sour, if packed away with any of this dampness upon it. But hay when perfectly dry may be put away with much of the sap remaining in it; and though it sweats severely in the mow and becomes somewhat discolored from the heat, yet it is not the less relished by, nor the less nutritious to, the fatting cattle. This is the actual experience of some of the best feeders; but though no evil may come from giving such hay to cattle soon to pass into the hands of the butcher yet in the condition in which it is often given to fatting cattle, it would be quite pernicious to horses. There is reason to believe, that hay is generally too much dried; and with some farmers, the practice of curing it in the cock is much approved. In this case, the hay being perfectly dry from any external wet, after being slightly wilted in the sun, is made up into cocks. The second day these cocks are opened and afterwards doubled. In good weather it will soon become sufficiently cured to be carried safely into the barn. In bad weather it is in a great degree secure from the effects of rain, if the cocks are made up with care. In this way, the hay is never so much dried as to be broken; nor are the leaves and seeds, as in the common way of making hay by tossing it about a great deal, scattered and lost. Two of the best farmers in the county, residing in Bernardston, are of opinion, that herds-grass should not be cut until it is ripe, and the seed perfectly formed. They speak with confidence in this matter from having made many experiments in the fatting of cattle. They are persons, whose word is above question and whose judgment is entitled to great respect.

ON THE QUESTION OF TOPPING AND STRIPPING CORN. HARVESTING THE CROP.

From the same.

The subject of topping the stalks has been much discussed; and its inexpediency may be considered as settled. A Pennsylvania farmer, highly intelligent and observing, made an experiment with a view accurately to test this point. Taking three equal rows in the same field, topping two and leaving one untopped, the result was as follows:—

"Produce of the row which had not been topped, nine bushels and five-eighths of corn in the ear.

"One of the rows which had been topped and stripped,—that is, the blades of the plant taken off,—measured seven bushels and six-eighths; and the other, topped and stripped, measured seven bushels and three-eighths of corn in the ear. Thus it clearly appears that mutilating the corn plant before its fruit is perfected, is a very injurious practice."

The experiment of Josiah Quincy, of Quincy, Norfolk county, was to the same effect. This was upon carrots, and I shall give the account in his own words:—

"It was stated confidently, by some English writer on the cultivation of carrots, that the tops might be cut early for the purpose of feeding cattle which were soiled, not only without injury, but even with benefit, to the roots, which it was said, would in this way grow larger. Mr. Quincy took twenty-six beds of carrots in the same field and of the same size, with a view of fully testing these statements; and in the month of July, when the lower leaves first began to wither, he caused every other bed to be cut as directed, being careful not to crop the crown or the head of the root—so that there was a cut to an uncut bed alternately through the whole piece. They were gathered, and the roots measured carefully, on the 20th October. The total product of the uncut beds was 104½ bushels: the total product of the cut beds was 58 bushels. Judging by the eye, the size of the roots of the cut bed was nearly two thirds less than that of the uncut bed."

But the question may be considered as put to rest by the experiment of William Clark, Jun., of Northampton, Hampshire county. The experiment was conducted with much care and intelligence; and, omitting several of the details, I shall give only the results:—

Row No. 2, on which the experiment was commenced, was as follows, viz:

46 hills on which the stalks had not been cut, gave - - -	42 lbs. 8 oz.
Dry shelled corn, equal per acre to	bs. 60, 8 lbs.
46 hills from which the stalks had been cut, gave - - -	33 lbs. 7 oz.
Dry shelled corn equal per acre to	bs. 47, 18 lbs.
The loss by cutting the stalks per acre was - - - - -	12 bs. 46 lbs.

The four rows taken together, stand as follows:

No. 1 and 4, on which no stalks were cut, gave an average per acre of 60 bs. 8 lbs.

No. 2 and 3, from which half the stalks were cut gave an average per acre of 54 bs. 25½ lbs.

Loss by cutting half the stalks per acre, - - - - - - 5 bs. 38½ lbs, or cutting all the stalks would make a loss equal per acre to - - 11 bs. 21 lbs.

The difference in the result of the two cases is 1 bs. 25 lbs. per acre; or in the two experiments, if it may be so termed, there is an average loss by cutting the stalks, of 12 bs. 3½ lbs. per acre; a loss quite equal to all the expense of hoeing and harvesting. Mr. Clark adds, "if this experiment is a fair test, it seems that about twenty per cent. or one-fifth part of the crop is destroyed by cutting the stalks in the way they are usually cut." Another exact farmer in Conway has made a similar experiment in reference to this very point. By a careful measurement he states that the difference between cutting the stalks at the customary time or leaving them uncut until after the corn is ripened was eight bushels per acre in favor of the latter practice.

Mr. Clark advances another opinion, which is

quite conformable to my own and to the experience of many other farmers. "This twenty per cent. is not saved at the expense of losing the stalks; they are worth as much, and I think more, all things considered, after the corn is harvested, than they are when gathered in the usual way. If, after being bunched up in a green state, they heat or become mouldy, (a case of frequent occurrence,) they are utterly worthless, except it be for manure; I know of no animal that will eat them. But after they have once been dried by the sun and wind, a subsequent moderate degree of mouldiness, seems to be no injury." This conforms to the opinion of one of the best farmers in Northfield, Franklin county, who is in the habit of gathering his corn and then cutting up the stalk at the ground.

The mode of harvesting Indian corn is of considerable importance. On this subject the opinions of farmers are at variance. Some choose to top the stalks as soon as the corn is glazed, and gather the corn after it has become fully ripened. Others prefer leaving the whole until the grain is sufficiently ripened to be cribbed, then gathering the corn, husking it as it is gathered, and collecting the fodder afterwards. Others choose as soon as the corn is glazed, or is so far advanced that an ear fit for roasting is not to be found in the field, to cut the whole up at the ground and shock it in the field for ripening. This practice, is almost universal in New York, but it prevails only partially in Franklin county, where in general the first described mode of harvesting is adopted. In many places the but-stalks after the corn is gathered, are left in the field to be browsed by cattle, a management which is wasteful, and has nothing to recommend it.

I shall take the liberty in this matter to detail my own experience, while a resident in this county. The leaving the corn untopped until it is sufficiently advanced for gathering, and then cutting it up at bottom, allowing it to finish the ripening in the shock, has sometimes with me been attended with success. In some cases, however, I have had by this management so much mouldy and soft corn as to question its expediency. But as I think I have discovered the causes of my failure, this method now commends itself strongly to my judgment.

The summer of 1832 was so cold, that corn generally was three weeks behind its usual condition; and fears were entertained that the crop would be entirely cut off. On the 9th of September there was a slight, and on the 12th and 13th, there were severe frosts. Corn was generally in the milk; and, in many places, much was killed. The fogs on the river near my residence served as a protection to my crop. Under these threatening appearances, fearing through delay the loss of my whole crop, I determined to cut up the whole at the ground as soon as it should be slightly glazed; and the results and facts in relation to it, I took pains to record.

I was desirous to ascertain whether corn cut in the milk and not at all glazed, would ripen. Three stalks with one ear on each were cut in this condition and placed in as favorable a situation as possible for the access of the sun and air. They ripened perfectly; and to appearance became as fair and hard and heavy as any; but the experiment on a whole field could not be advised, as so favorable a situation for curing a large quantity could seldom be obtained. I began cutting my corn on the 14th September, after having previously cut out the suckers and barren stalks. In the field which I took first, the corn appeared dead; but this was occasioned by the rust, not by the frosts. This corn being cut at the bottom and not suffered to be laid upon the ground, several hills were brought together, the stalks were spread widely at the bottom, and were tied by a single band at the top. Much of this corn upon husking, appeared of a pale yellow, and a good deal of it was soft and mouldy. The shocks did not stand firmly, and many were over-turned by the wind. The centre hill, around which the stalks were gathered, should not have been cut until the time of husking, but should have been left as a support to the shock. Another field where the corn was slightly glazed and the stalks very green, was cut, tied in small bundles above the ears and put in small shocks or stooks. This came out better than the former, but not so well as could be desired. It was cut too early, and was not suffered to remain long enough in the shock.

Two other fields were necessarily left to a later period after the corn had become fully glazed, that is in the main every kernel on an ear was well touched, though the stalks were still green and succulent. It was tied near the top in small bundles; put up in small shocks, and spread at bottom so as to give free access to the air. This corn at husking came out bright and sound, with less refuse than ordinary; and the fodder was succulent and of the best quality.

There is a small matter connected with this subject to which my attention was directed by an excellent farmer in the county. His advice was by no means to shock the corn, thus cut up and gathered, upon grass ground, as is often done on the borders of the field, because the grass is likely to exclude the air from the bottom of the shocks. Upon the whole my own judgment, especially liable as we are to early frosts, is to cut up and shock the corn as above described as soon as it is well glazed; and it is a safe error to do it too early rather than too late. The fodder in such case is always of superior quality.

RELATIVE MERITS OF BERKSHIRES AND WOBURNS—BANTER FROM MR. MAHARD TO DR. MARTIN.

From the Kentucky Farmer.

The reader will find below a letter written by Mr. Mahard upon the relative merits of Woburns and Berkshires. We have admitted it on the ground that it discusses facts interesting to the breeding public in relation to two popular breeds of swine and particularly as it proposes a test of their comparative merits in a way more satisfactory than any hitherto tried. At the same time, however, we regret to perceive that Mr. M. has adopted a style of discussion calculated to provoke a controversy likely to degenerate into personality. Although individually sick and tired of mere paper discussions on the question, which is the best breed of hogs, we do not feel at liberty to decline discussions which may lead to the discovery of

truths useful to the pork raisers of the country. Yet we dare say that, if we were to exercise our right of either returning the communications of gentlemen or of expurgating their personal and offensive expressions, they would get into a higher passion on account of the act than they exhibit in their productions. There is an exceeding degree of sensibility manifested by breeders whenever a discussion of the merits of this or that breed of animals is in hand. As much heat is exhibited, by the advocates of the various breeds, towards each other, as is usually observed between the different political parties. We shall take no side in these controversies. Throwing our pages open alike to all, we have only to say to each, bring forward your strongest facts and give our readers the benefit of them. * * * —*Ed. Ky. Far.*

Cincinnati, 2nd Dec., 1841.

To the Editor of the Kentucky Farmer:—I find on looking over various agricultural papers of the United States, that Dr. S. D. Martin of Kentucky, has published a trial made by himself and James F. Taylor, of feeding a Berkshire sow and two Woburns, for ten days, and as the whole particulars of the case have not been published by the Doctor, I feel anxious that they should be, for the information of all concerned, and as he is such a stickler for *facts*, he of course will have no objections to what I am about to state.

What I learned of this trial of feeding between Doctor Martin and Mr. Taylor, was at the Doctor's own house last September, when I visited him in company with Mr. Affleck, editor of the Farmer and Gardener. Here I met Mr. James F. Taylor, and heard him and Dr. M. discuss the whole subject, and I must confess, after which, I could not but wonder that the Doctor had come out in the public prints and published this trial, as I think it can be made to appear from all the facts in the case, that he has gained nothing by it, only so far as it helps to make a noise about his hogs, and keep them before the public.

It appears on the 13th August last, Mr. Taylor placed a Berkshire sow of his, and Dr. Martin two Woburn sows, in the hands of a Mr. Weathers, a disinterested man, to be fed for ten days, on 5 pounds of corn per day. Mr. Taylor is a nephew of the Doctor, and Mr. Weathers is a tenant. These things I state because they are facts. Well, as to the result, Doctor M. and Mr. T. agreed as to the gain of the Berkshire sow and one of the Woburns, which they said was 21 pounds each on fifty-two pounds of corn in ten days, but upon that of the other Woburn sow, Courtney, on the same allowance and same number of days they disagreed. Doctor, M. asserting that she had gained 30 lbs., while Mr. Taylor contended that she was incorrectly weighed, and that he did not believe that she had made any such gain. I now contend that Doctor M. has published to the world what is not a fact, for it is disputed by his own nephew, Mr. T., that the Woburn sow, Courtney, did gain as much as was represented she did.

The Doctor goes on to state, from this trial made with Mr. Taylor, that it is a fact that the Berkshire hog is a greater consumer than the Woburn. (See his communication particularly to the Tennessee Agriculturist, November No. p. 259.) Now only hear what he told me in a private conversation on this very subject. He said that on the day he brought home his Woburn sows from Mr. Weather's, he told his man Patrick to put up Courtney and give her as much as she would eat for two days, and then they would weigh her again. He did so, and found she eat a bucket of swill! a bucket full of apples! and nineteen ears of corn! and gained 19 lbs., and from these facts, the Doctor concluded that the Berkshires were the greatest consumers! The gain of 19 lbs. in the two days was principally in the weight of food given her, and with which she had gorged herself, and I believe just as much in it, admitting that the Doctor was correct, as I do in an animal gaining 30 lbs. of *flesh* on 51 lbs. of corn. Such a thing is utterly impossible, and if she did weigh 30 lbs. more at the end of the ten days, it was because her stomach was full of water, or something else besides the 51 lbs. corn consumed.

It will now be seen, that the trial between Messrs. Martin and Taylor proves nothing at all to me, regarding the relative merits of the different breeds of swine, and inasmuch as the Doctor has been bragging and bantering the whole world to feed against his Woburns, and as I do not believe that there has ever been a fair test yet made, I propose selecting six of my Berkshire pigs, 3 months old, and I call upon Dr. M. to select the same number of his Woburns, and put them into the hands of a disinterested man together, to be fed from twelve to fifteen months in the usual method of feeding hogs for pork—to pasture them in the summer, and to have all the grain measured that they consume, and then let them be drove to this market or to any other that may be agreed upon, and the hogs weighed alive, then killed and weighed again, and the whole trial be published to the world.

I am now busy in packing pork in Covington, Kentucky, and I wish to mention a *fact* with regard to a lot of 103 head of hogs, 69 of which were *one-half* and *three-quarters* Berkshire, belonging to N. McNeese, of Harrison county, Kentucky, the whole averaged 268 lbs., gross at home, and after being driven 50 miles to this place, and kept on hand for several days, they were slaughtered and weighed 219 lbs. net. The usual loss between gross and net lots, in common hogs, is one fourth and over, this shows a gain of 18 lbs. per head in this lot; and had the Berkshire cross been weighed by themselves, it would have been still greater. I do not think their loss between gross and net weight would have been over 40 lbs. a hog, or less than one-sixth.

So thoroughly am I convinced in my own mind that the Berkshire hog is superior to all others, that I am anxious to have a fair and impartial test made between them and any other breed, and the sooner it is done the better. As far as I have been able to learn from those to whom I have sold Berkshire pigs, none have been disappointed in them. A correspondent of mine writes from Tuscumbia, Alabama, under date of 19th November last, informing me that a lot of Berkshire pigs I had sent him had arrived safely. He said he had an opportunity of seeing one or two pairs of Doctor Martin's thorough-bred Woburns. "There is," says he, "humbuggery in the Doctor, his hogs *won't do what he says they will.*"

"They are a large boned, coarse hog, and not a good shape, and as to their being sustained on less food than any other breed of hogs is out of the question, his experiments to the contrary notwithstanding. To say that a large boned, coarse haired hog, that will not mature short of 3 years, and weighing from 8 to 1200 pounds, can be sustained on the same amount of food that a neat boned, muscular, compact hog, that will mature in from 12 to 20 months, is contrary to nature and philosophy, and any individual instance to the contrary only proves an exception to a "general rule." He further remarks, "that the Doctor states in a letter to a friend of mine, that he has not ascertained at what age his Woburns would mature, as he has never fed any long enough, though he has fatted some over three years old!!"

Those papers that have copied Dr. Martin's trial of the Woburns and the Berkshires will, as an act of justice, please do the same with the above. Most respectfully,

JOHN MAHARD, Jr.

[We have given place to the foregoing article, not because we approve its *manner*, or take sides with the writer, but because we had published the previous article commented on. It is unfortunately the fact that there is a great deal of humbug in every branch of stock-breeding and selling, by which the salesman can derive large profits from exaggeration and deception. Without meaning to detract from the real merits of either the Woburn hogs, of which we know nothing practically, or of the Berkshire hogs, of which we know something, and think favorably, we are well satisfied that there is much more of humbug than of truth in the high-colored recommendations of both, and especially of the latter, because best known to us; and that of the numerous communications published in commendation, much the greater number are merely elaborately constructed and carefully disguised breeders' and salesmen's advertisements and puffs. Of course, this and every one of many such expressions of our opinion, is calculated to injure our interests with the most active and influential writers for and supporters of agricultural periodicals, who are (unfortunately) the producers and sellers of humbugs, in some one or other department of agriculture. And not only do we thus lose the favor and incur the hostility of the whole humbugging class, but fail thereby in pleasing their victims, or agricultural readers in general, who are much better satisfied (at the time) when cheated, than to be warned of and guarded against deception. Even when deriving no *direct* gain or reward from aiding the system, it is greatly to the pecuniary interest of an agricultural editor to act as if guided by the motto. "Humbug for ever!" and to lend his publication entirely to such service, so far as demanded.—ED. F. R.]

From the (Nashville) Agriculturist.

POTATOES, GAPES IN CHICKENS, TETTER, MOSQUITOES.

To Dr. J. Shelby—dear sir—Agreeably to your request, I send you the root part of a corn stalk, raised in the following way. I dug a trench about 20 inches deep. One object was to try an experiment with potatoes, to see if they would thrive well at a considerable distance beneath the surface. I planted my potatoes with a few grains of corn at the bottom, covered with chip manure, mixed with the soil, and after they came up, I filled the trench as fast as I could without smothering them. I at the same time planted two grains of corn on the surface near by, one of which I cultivated by hoeing about it and making a hill, and to the other I made no hill, nor loosened the soil near it. The season was a very dry one, with but little wind when the corn was in blossom. When it was ripe, I found a good well set ear on the stalk, I did not cultivate, further than to scrape away the weeds and grass. None of the others produced as well, which I supposed might be accidental. I hilled up the trench so as to make it about two feet from the bottom. The next spring I dug my potatoes and found a very poor yield, though I found potatoes at all depths. I have since tried the same experiment in potatoes in a good season, and with nearly the same success. I was induced to try the experiment from one I had tried before. I took sprouts from potatoes and planted them in hills in my garden, and cultivated them as usual. In the fall I dug them, and their yield was moderate. I overlooked one hill which came up the next spring, and as they were of the late kind, I knew they would produce but little under the common mode of cultivation, and continued to hill them up to within about six inches of their top until fall. When I dug them up I found about a dozen very large good potatoes, and but one too small for cooking. I suppose it is known that the late kind of Irish potatoes, if planted early in this climate, hardly yield the amount planted. The best time to plant is from 25th of June to 1st August. I suppose it is likewise known that the growth of potatoes can be protracted by hilling them up. Hill up potatoes that are in blossom, and the blossoms will fall off. A new growth commences, and in time they will blossom anew. In this way one can put off the ripening of early planted potatoes till fall.

There is in this climate a difficulty in keeping potatoes from deteriorating in quality. They will keep in some parts of France by burying them 3½ feet beneath the surface. I have tried them here 5 feet, and still they were within atmospheric influence. I once found a small piece of sweet potato, perfectly sound, four feet beneath the surface, in what had been a potato cellar beneath my kitchen, which to my certain knowledge must have been there ten years, and I believe twenty. From thirty years' experience in this county I am convinced that the surest way to raise the largest and best Irish potatoes with the least trouble is to have them so near the surface that the ground will crack as they expand. I am not certain but the same may be true in sweet potatoes. * *

I have seen in the Farmers' Register, as taken from the Cultivator, two communications upon gapes in chickens. Their authors appear not to

understand the cause or best mode of cure, both of which are very simple. One recommends as a preventive, the taking of the chickens early from the hens and "scanting them in their food." A fine way, indeed, for having fat chickens for the table! The French mode of starvation for the cure of disease is founded in philosophy, but a deeper philosophy rejects it altogether.

It has been a long time observed that when a person settles a new place, it will be a year or two after he gets a hen-house before there will be gapes among his chickens. I believe those who have no hen-house or covered place for hens to roost or set in, are never troubled by the gapes. Some have two hen houses, keeping one uncovered alternately through the year, and so avoid the gapes. If you will examine a hen coming off with chickens that will have the gapes, you will find her abounding in lice, which will be communicated to her chickens. Should you take these chickens previously, and keep them from being lousy, they will not have the gapes, and there will be no necessity for "scanting their food." It is possible that chickens already having the gapes may have life protracted and perhaps get well by "scanting their food," on the principle practised with patients, whose vitality is nearly extinct. Lice are continually sucking the blood of their victims. If you will cut open and examine a chicken having the gapes, you will find one or more long worms in its windpipe, obstructing its breathing. These sometimes can be thrown out by taking the chicken with its head from you, raising it up at arms length, and bringing it down very quick.

If you will examine the blood of a gaping chicken, you will find it pale and thin; a sure sign that it lacks iron. Under this belief more than twenty years ago, and after having tried every known remedy to no purpose, I concluded to try iron. I take rusty nails, iron turnings or filings, put them into an unstopped bottle with good vinegar, and set it in the sun, often shaking it till it becomes black. I put a table-spoonful of this into the dough, which I feed, and with it cure or prevent the gapes. I once gave it to a sick hen, that was pale and so weak that she could neither walk nor stand without falling forward or back, and in a few days she was well, and afterwards raised six or more broods of chickens. Was not this disorder the pip?

I published the remedy eight or ten years ago, and was informed that a certain gentleman, once somewhat noted as a lawyer, and since as a preacher, used it and said it killed every creature that ate it. He must have got iron filings mixed with brass, which is common in most mechanics' shops. I have constantly used it, when needful, and have never know any harm from it. I have a hen-house, but my hens roost on the trees near the house, and although I have seldom less than thirty, and often more, and raise chickens, I have not had an instance of gapes for several years. A setting hen or other fowl is said to have fever, because their heat is greater than at any other time; but it is not fever. It lacks every characteristic of fever, but increased heat. * *

Farmers and laboring men, as well as others, often suffer from tetter, a disorder, which is often attempted to be cured, and not always with success. The fee for trying to cure, and I suppose commonly with aquafortis, is said to be sometimes $10. Perhaps a dozen years ago, I often had an itching humor on the backs and sides of my fingers, which was quite troublesome. In two or three weeks numerous small pimples would arise, containing a fluid, which I would let out with a sharp pointed knife. Then they would heal and disappear for some weeks, when they would come on again in the same way. After two or three years the humor appeared to quit the fingers and come into the palms of my hands. They would at first itch, and then in places appear as if scorched, and then the skin would crack. I soon learned it was tetter, for I had known nothing of the disorder. On inquiry I found it was seldom cured, and having no ten dollars to give as a fee, I determined to search for a remedy until I found one. I believed that vegetables contained an antidote for all disorders, and sought a remedy among them. I tried various things for three years or more before I found one. One day, walking in my garden and passing some rue, I recollected having heard that if a person handled rue, when the dew was on, it would blister. I took some leaves and rubbed them in my hand, and instantly the itching ceased. I pounded some and added water to it; and rubbed it on my hands frequently, and in about three weeks the tetter entirely disappeared. But it shortly broke out again, and I cured it again. This convinced me it was a humor pervading the system. After a while it appeared only in the spring and fall, and so continued to do for two or three years, when it ceased altogether for several years, and I supposed I was free from it, until a few weeks ago, when it came on as bad as ever; but I soon cleared it out. You undoubtedly have heard that "rue and rum" was once a catholicon. Of course it can be used internally with safety. Those who wish to expel the tetter virus totally from their systems, can drink rue bitters. I have had no opportunity of trying rue on tetters except on the hands, but suppose it will be equally efficacious, wherever the disorder may be. I have only to caution all who use it externally, not to suffer the sun to shine long upon the parts wet with it, for several days; for sunshine will produce inflammation.

As it sometimes happens that children lose their lives by eating Jimson (stramonium datura) and as I did not know that any specific had been discovered against it, I a few years ago tried a sort of experiment with the view of finding one out. Passing a barrel, which had stood too or three days nearly full of rain water, I saw thousands of little wiggle-tailed animals. (A learned man would have called them embryon or chrysalis mosquitoes.) They darted to the bottom immediately; but soon rose with their mouths to the surface, to enjoy the warm sun and the air. I watched them several days, wishing to see them shuffle off their "mortal coil" into mosquitohood. A full grown one would rise with its back a little above the surface, and after a short time its shell would open at the top and expand into a complete boat. (Perhaps antiquarians trace keel boats to this origin.) Shortly a mosquito would raise itself on its tiny legs, and stand erect. After a little it expanded and dried its wings, and then flew and perched on the side of the barrel. Having sufficiently satisfied my curiosity with *Mosquitology*, I gathered a parcel of Jimson weed,

and cutting it up fine spread it thickly on the surface of the water. There were many interstices between the pieces, where shoals of the little merry fellows could enjoy their pleasant sunshine. In two or three days I found none near the surface. They kept at the bottom, where they could not come to maturity. I noticed this until I was satisfied that the poison at the surface prevented their rising. I then sprinkled a pound or more of slacked lime upon the top. A part fell to the bottom, and a part remained at the surface. Shortly my little pets rose to the top "as merry as crickets." A mosquito can hatch out only at the top; for they drown as easily as a fly.

Should any one about me become poisoned with Jamestown weed, I should give lime water as a specific. WILLIAM CHANDLER.

Mill Creek, near Nashville, Dec. 1841.

UNITED STATES AGRICULTURAL SOCIETY.

Constitution of the Society

The style of this society shall be, "*The Agricultural Society of the United States.*" Its objects shall be to improve the condition of American husbandry, and, from its central position to serve as a medium of communication and of action with other agricultural societies throughout the union.

Article 1. This society shall consist of such members as shall, at the formation of the same, sign the constitution, and pay to the treasurer two dollars, and one dollar annually thereafter as long as they shall continue members.

Art. 2. Any citizen of the United States may become a member of this society by paying the fees required for membership.

Art. 3. Any agricultural society in the United States shall become an auxiliary society, upon paying to the treasurer the sum of ten dollars, upon application, and five dollars annually thereafter; and each auxiliary society shall receive no less than five printed copies, of the annual proceedings of this society, and shall also be represented by such delegate or delegates as it may appoint to the annual meeting of this society, and on all questions to be decided by the society such delegation shall be entitled to ten votes.

Art. 4. Any person paying to the treasurer ten dollars shall receive a diploma of membership for life.

Art. 5. The officers of this society shall consist of one president, one vice president from each state and territory, and one from the district of Columbia, a recording secretary, a corresponding secretary, and treasurer, and a board of control, consisting of five members, three of whom shall constitute a quorum.

Art. 6. The president, and in his absence one of the vice presidents, shall preside at all meetings of the society. By the concurrence of the board of control he may call special meetings of the society, giving public notice thereof, by advertisement, at least three weeks before said meeting. He shall draw all drafts on the treasurer for moneys paid out, which drafts shall be countersigned by the recording secretary; and the treasurer shall, at the next annual meeting, make a full statement of all receipts and expenditures, setting forth as well the items as the amount thereof.

Art. 7. The vice presidents of the states of Virginia, Maryland, Pennsylvania, and Delaware, and of the district of Columbia, shall be ex officio members of the board of control, provided no act shall be done by said board without the presence of a quorum of the original board.

Art. 8. The recording secretary shall keep a full record of all the proceedings of the society, and supervise the publication of them as he may be directed.

Art. 9. The corresponding secretary may be one of the five members constituting the board of control, and in addition to conducting all the correspondence of the society, shall keep a record of all expenditures ordered by said board, and, in short, perform for said board all the purposes of a secretary, and shall receive such compensation therefor, as said board, with the consent of the president, may allow.

Art. 10. The board of control shall consist of five members, living in, or at a convenient distance from this city, who shall perform all the executive duties necessary to the purposes of the society not especially assigned to other officers. They shall avail themselves of all the means in their power to become acquainted with the agriculture of foreign countries, and through such aid as they may be able to receive from our diplomatic agent abroad, as well as our consuls, shall, if consistent with the pecuniary means of the society, introduce from abroad whatever they may think materially calculated to improve the agriculture of this country, whether it consists of information as to new and improved modes of culture, seeds, plants, additional articles of cultivation, agricultural implements, or domestic animals; the disposition of which shall be made at the first annual meeting of the society.

Art. 11. The board of control shall also use the necessary means of having a large exhibition, at each annual meeting, of improved agricultural implements and machinery, with full and public trials of the same; of improved stocks of all kinds, and particularly of inviting the exhibition of such animals as have taken premiums at other agricultural shows, with a view of testing the superiority of prize animals themselves; also of the different breeds of animals, for the purpose of comparing the advantages of each. They shall affix to such exhibitions such premiums as they shall adjudge suitable, appointing such judges as they may select to award the same, which judges shall not only assign their preferences, but shall draw up a detailed report of their several examinations; setting forth fully a description of the articles or animals adjudged, and the grounds upon which their preferences are awarded.

Art. 12. It shall further be the duty of the board of control, when they think it expedient, to procure a model of such implement and machinery as may have received a premium, to be kept in some suitable and convenient place, selected as an agricultural repertory, for the inspection of the public, and particularly of members of the society.

Art. 13. The said board may also award premiums for prize essays, to be read before the society, for well conducted and well reported experiments in agriculture, having reference in the

same to the pervailing agricultural productions of the different societies of the union.

Art. 14. The said board shall give due notice, by advertisement, of the time and place of such exhibition, the premiums to be awarded, and the committee by whom they are to be awarded; and for the expense attending the discharge of the duties herein imposed, they shall draw requisitions on the president, setting forth, severally, the items of expense, which requisitions shall be recorded by the recording secretary, and the president, if he approves the same, shall thereupon issue his draft on the treasurer for the amount.

Art. 15. The said board shall also be instructed to make efforts to obtain funds for the establishment of an agricultural school in the district of Columbia, and, appurtenant thereto, a course of public lectures on agriculture, chemistry, botany, mineralogy, geology, and entomology, as appropriate sciences to the great *business of agriculture*, and an experimental farm, which, with the buildings and improvements thereon, shall be set apart for ever "*as an establishment for the increase and diffusion of knowledge among men.*"

Art. 16. The board of control shall procure an appropriate seal for the society, to be attached to diplomas or other documents or instruments which may be issued to honorary members or other persons, under the direction of the society. They shall fill all vacancies that may occur by death, resignation or otherwise, either in their own body, or the list of the officers, to continue until the next general meeting.

Art. 17. In further aid of the purpose of this society, the said board shall invite some suitable person to establish an agricultural publication in this city, and shall also petition congress for the incorporation of this society.

Art. 18. The first general meeting of this society shall be in the city of Washington, on the first Wednesday in May next, and thereafter at such times as the society may direct.

Art. 19. All moneys paid to the treasurer, either for subscriptions or as donations to the society, shall be deposited to the society's credit in such bank or institutions as the board of control may direct, and can only be withdrawn upon the requisition of the president or acting president, countersigned by the secretary and treasurer.

Art. 20. This constitution shall be amended only by a vote of two thirds of all the members present at an annual meeting of the society; but the board of control may, by the aid of the president, establish any needful by-laws for the better order of the society not incompatible with this constitution—which by-laws may at any time be amended by a majority of the society present.

Art. 21. Elections for all officers of the society shall be held by ballot at every general meeting thereof; but, until an election at the general meeting in May next, the following persons shall be a committee to appoint the officers hereinbefore mentioned, and to make publication of the same, in ten days from this time:

The Hon. Levi Woodbury, of New Hampshire; Hon. Lewis F. Linn, of Missouri; Hon. Wm. C. Rives, of Virginia; Hon. Wm. Cost Johnson, of Maryland; Hon. Dixon H. Lewis, of Alabama; Hon. John Hastings, of Ohio; Hon. H. L. Ellsworth of the District of Columbia; Hon. John S. Skinner, of the District of Columbia; and John F. Callan, Esq. of the District of Columbia, were then appointed a committee to select the officers of the society provided for in the constitution, to serve until the regular election in May next.

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The committee, appointed by the Agricultural Society of the United States to select the officers of the society to serve until the first general meeting and exhibition on the 4th day of May next, have met, and do hereby recommend and report the following gentlemen to fill the offices annexed to their respective names. The recording secretary is requested to publish the names, and give special information to each individual of his selection.

LEVI WOODBURY.
Chairman for the Committee.

President, James M. Garnett; *Corresponding Secretary*, John S. Skinner; *Recording Secretary*, John F. Callan; *Treasurer*, Edward Dyer.

Board of Control—Levi Woodbury, Elisha Whittlesey, Alexander Hunter, John A. Smith, W. J. Stone.

Vice Presidents—Maine. George Evans; New Hampshire, Isaac Hill; Massachusetts, B. F. French; Connecticut, Eli Ives; Rhode Island, Gov. Fenner; Vermont, Wm. Jarvis; New York, C. H. Bement, New Jersey, C. S. Green; Pennsylvania, George M. Keim; Delaware, J. W. Thompson; Maryland, Thomas Emory; Virginia, Edmund Ruffin; North Carolina, Edmund Deberry; South Carolina, Wade Hampton; Georgia, W. Lumpkin; Alabama, Dixon H. Lewis; Louisiana, Alexander Mouton; Arkansas, Archibald Yell; Tennessee, F. H. Gordon; Mississippi, M. W. Phillips; Kentucky, Chilton Allan; Missouri, Lewis F. Linn; Illinois, A. W. Snyder; Indiana, Solon Robinson; Michigan, Isaac E. Crary; Ohio, John Hastings; District of Columbia, H. L. Ellsworth; Florida, R. W. Williams; Iowa, Timothy Davis; Wisconsin, Henry Dodge.

The vice presidents of Virginia, Maryland, District of Columbia, Pennsylvania, and Delaware are ex-officio members of the board of control.

J. F. CALLAN, *Rec. Sec.*

[Though it is contrary to our usage to publish the constitutions and preparatory proceedings (of merely *intended* operations) of new agricultural societies, we have made an exception to that usage in favor of the "United States Agricultural Society," recently instituted at Washington—an exception due to the magnitude of the plan and object, and also to the public spirit and patriotic views of the individuals who have founded the society. But neither our high respect for the founders, (the principal of whom are also our valued friends,) nor the unexpected and unsought honor which the society awarded to us among their appointments to office, will prevent our again expressing the opinion and the fear that a society so constituted, and so located, cannot possibly *work right*, nor do much good in promoting agricultural improvement, compared to the results that might be produced from the operation of as much talent, zeal, labor and money, di-

rected differently. It cannot be expected that any considerable number of individuals, or enough to maintain the semblance of a "United States Agricultural Society," can be induced to travel to Washington, from all the states of the union. And even if such incredible sacrifices were made, and some members were to attend from Maine, Iowa, Missouri, Louisiana and Florida, as well as from the near neighborhood of Washington, what could be expected from their meeting, more than the usual and almost useless procedure of agricultural societies in general? And if no more should be done, no member would again travel 1000 miles—unless he had other work to do, and private interests to attend to at the seat of government.

It is not that there are not excellent and abundant materials and means at Washington for an agricultural society of more humble pretensions, and yet of far greater utility than this. There are some resident individuals there, whose names appear in the foregoing proceedings, whose general intelligence, zeal for and knowledge of agriculture, would dignify and utilize any properly constituted district society; and such a society would be greatly aided by facilities peculiar to that locality. But these individuals and these means will receive no additional aid by belonging to an organization and plan so ambitious as to be made coextensive with the whole space of our enormous territory.

But whatever may be our anticipations and fears, we shall most heartily rejoice if they shall prove to be unfounded, and the value and results of the "United States Agricultural Society" shall be shown to be equal to the most sanguine expectations of its founders.

VIRGINIA SALT MINE.

From the Journal of Commerce.

I received last week, from my correspondent, Alexander Findley, Esq. of Saltville, Washington county, Virginia, a package containing, among other geological specimens, several pieces of rock salt, or sal gem, which is of a very superior quality. I have left a sample of it at the office of the Journal of Commerce, for the inspection of any person who may wish to examine it. The rock salt is slightly tinged with a reddish color. This is the first salt mine found in the United States east of the Mississippi river and the great lakes, and may well be reckoned a great treasure. The stratum is about one hundred and fifty feet thick and reposes on a bed of plaster rock, and is a little more than two hundred feet below the surface.

The section of Virgima where this salt mine is located lies between the Clinch mountain and the Blue Ridge, and is near the line of East Tennessee, about equal distance from Nashville in Tennessee and Richmond, Virginia. I have also received a sample of most beautiful table salt, manufactured at the salt works at Saltville by evaporation.

I have put up specimens of the rock salt to forward to the state geological cabinet at Albany.

This salt mine was discovered in boring for salt water—and although it is so near the surface, the proprietors find it more profitable to evaporate the brine which yields about two pounds of pure salt to the gallon, in preference to excavating the sal gem. The state of Virginia is rich in her mineral deposites—of iron, coal, salt, plaster and gold—iron, coal, salt and plaster are generally found near together. E. MERIAM.

From the Kentucky Farmer.

RELATIVE WEIGHT OF GRAIN AND COB OF INDIAN CORN.

Bourbon county, Dec, 13, 1841.

To the Editor of the Kentucky Farmer—In looking over your interesting periodical, I sometimes meet with notices of fine ears of corn produced in our country. Now in order to enable your readers to understand precisely how good they were, it seems to me that your correspondents should, in describing them, give us the exact weight of the corn both on the cob and when shelled, as this would afford a very certain standard. The length or girth of the ear, the number of rows or grains, are too uncertain measures by which to determine the excellence of an ear of Indian corn. A reflection of this kind led me while gathering my corn to make the following experiment:

On the 17th November last, without any very great care, I selected twelve of the most remarkable ears that were convenient to hand. The whole, being quite dry, weighed thirteen pounds good weight on the cob. The longest ear measuring thirteen inches in length, but only $5\frac{7}{8}$ inches in circumference was the lightest of the twelve, and contained 742 grains. The shortest ear measuring $8\frac{1}{2}$ inches and $8\frac{1}{4}$ inches in girth, had 22 rows and about 1100 grains—the greatest number of grains on any of the twelve—but the ear was much lighter than many others of the dozen. The heaviest and best ear of all measured only nine inches in length and $8\frac{1}{8}$ inches in girth, containing 18 rows and about 846 grains, it weighed 1 lb. $3\frac{1}{4}$ oz. unshelled; the corn when shelled weighed $15\frac{1}{2}$ oz. I did not consider this a very remarkable ear for size; but the experiment shows how much the eye may deceive us as to the relative value of an ear of corn. Among the dozen there was one ear, selected by several as being decidedly the finest and best. And certainly its appearance was prepossessing, being 12 inches long and $7\frac{1}{4}$ inches in circumference, containing only 14 rows and about 700 grains, which, however, were very large, wide and full. This ear was the second in weight, mark that, weighing 1 lb. 3 oz.; the corn it shelled weighed $14\frac{1}{4}$ oz. having a much heavier cob than its successful competitor. The description of corn is the white flint; and considering that the past season was not the best for corn, I think mine tolerably good. The above experiment has suggested to my mind an important improvement that I think may be made in corn. I intend to try it, and if I succeed will in due time inform you as to the result. I am, respectfully, yours,

JNO. ALLEN GANO.

BROOM CORN.

From the Fourth Report of the Agriculture of Massachusetts.

Broom corn (*Sorghum saccharatum,*) is the next most important crop grown in the county of Franklin. Its cultivation is chiefly confined to the meadows on the Deerfield and Connecticut rivers, though there have been instances of large crops in the interior. Deerfield, Whately and Sunderland in particular grow large amounts of it; and it is said that the prosperity of the last-named town is mainly attributable to this product.

The average yield under good cultivation is from six hundred to eight hundred pounds of brush or broom. One thousand pounds are not unfrequently reached. Six to eight hundred pounds are reported as the average yield in Sunderland and Whately. A crop of seed is obtained about once in four years, and forty bushels of seed are considered a good yield. A respectable farmer in the county informs me that in one instance, he obtained one hundred and fifty bushels of seed to the acre. It is planted in hills at a distance of eighteen inches between the hills lengthwise; and in rows about two and a half feet apart, or at a distance wide enough to pass the plough or the cultivator. By some farmers, broom corn is planted in hills two and a half feet distant each way, and fifteen stalks are left in a hill. It requires good manuring; and is sometimes manured as Indian corn in the hill, or the manure is spread. The cultivation is more expensive than that of Indian corn. No crop is more beautiful than the standing corn, when in perfection; and it frequently reaches a height of twelve to fifteen feet.

The stalks of the plant are long and hard, and therefore difficult to load on a cart. They are generally considered as of no value excepting for manure. This, however, is an error. The Shakers at Canterbury, N. H., among the very best farmers in the country, are as careful to save their broom corn stalks, as their Indian corn stalks for fodder; and, for the feeding of their young stock, deem them equally valuable.

The usual mode of gathering is to table the corn, that is, to cut off the top, or tassel the broom as it is called, about two or three feet from the top, and bending the stalks of two rows together, lay it down and leave it until it is seasoned and fit to be gathered. The brush is then cut, tied in small bundles and carried in. The remainder of the stalks are burnt in the field the ensuing spring, and some little advantage is supposed to be derived from the ashes. Some farmers prefer, after gathering the brush, to cut the stalks and lay them lengthwise in the rows, and plough them immediately under. They will be entirely decomposed by the ensuing spring. A still better mode is to carry them into the cattle and sheep-yards, where they become incorporated with the manure and make a valuable addition to the compost heap. I am satisfied from the experiment of the Shakers, that if properly cured, they might be well applied to the feeding of young stock. It is deemed necessary by the raisers of broom corn to connect with it the feeding and fattening of cattle, that the necessary manure may be procured for the cultivation of this crop.

It is considered a profitable crop when the brush will command five cents per pound. The price has been subject to great fluctuations. Formerly, it was common for each farmer to make his brush into brooms, and sell them when and where he could. This was bad for all parties. It brought too many competitors into the market, and often unduly depressed the price. The buyers likewise were often obliged to put up with an inferior article. The growing of the brush and the manufacture of the brooms are now in different hands. The farmer, as soon as his broom is ready for the market, finds in the manufacturer a purchaser at a steady price; and the manufacturer knows that his reputation, and consequently his success likewise, is concerned in the quality of the article, which he furnishes.

The Shakers for a long time almost monopolized the raising of the corn and the manufacture of brooms, which, like other manufactures of this industrious community, were always of a superior quality and generally commanded a high price, usually 37½ cents a-piece or more. Now, corn brooms are frequently sold from 8 to 25 cents; but many of them are, like Pindar's razors, "made to sell." The handles in an unfinished state, made either of maple or ash, are furnished for a cent a-piece. The wiring and tying on are usually done by the hundred. The scraping the seed from the brush is an unpleasant business, and the dust is prejudicial to the eyes. A common flax comb is generally employed; but an improved machine, moved by horse power is coming into use, performs the work quickly, and greatly lessens the labor. The manufacture, when carried on extensively and with ample capital, has yielded encouraging profits.

The seed is sold at two-thirds the price of oats, and is ordinarily of the same weight. It sometimes weighs more than oats, and by some persons is more highly valued. It is by many esteemed good food for the fattening of swine, when mixed with other grain. Some have used it for fattening cattle and horses, but it is not approved. The saving of the seed of broom corn is, by the best farmers, deemed a matter of much importance. It must be taken from that which produces a full and square head; and not from that which runs up in a spindling form, and "branches like a pine-tree." The difference in the seed is deemed of so much consequence, that while ordinary seed for planting can be obtained at one dollar and fifty cents per bushel, the best always commands four dollars. In no single thing do farmers commit a greater error than in respect to seed. Inferior seed of any kind of plant should never be used; and the difference in the expense between good and poor seed is nothing compared with the increased value of the crop from good seed.

It is a fact, which certainly deserves mention, that broom corn is taken three, four, and sometimes ten years in succession from the same field without diminution of the crop. I have the testimony of three respectable farmers to this point. Yet this can only be done by high manuring. By many farmers it is deemed an exhausting crop. The brooms made from the brush, cut and dried while green, are tougher and much more durable than those made from the brush, when suffered to become quite dry and yellow. The returns of a crop of broom corn in Gill are as follows: the land cultivated was one acre seven rods. The crop of brush was nine hundred and thirteen pounds. Of

seed, there were one hundred and thirteen bushels; eighty bushels of which, sold for twenty-five cents per bushel. This was at the rate of eight hundred and seventy-five pounds of brush to the acre.

I subjoin, also, the exact account of a crop cultivated by Alvah Hawkes, in Deerfield meadows, with which he was kind enough to favor me.

Expense of cultivating one acre of broom corn.

One ploughing the 12th of May, - -	$1 25
Holeing out, one third of a day's work, -	34
Ten loads of manure at 75 cents per load,	7 50
Putting manure in the hills, - - -	2 00
Planting, one day's work, $1; seed, 4 quarts at 75 cents per bushel, - -	1 10
Hoeing first time, 3½ days, $3 50; hoeing, second time, 3 days, $3, - - -	6 50
Hoeing, third time, $2 50; horse and boy to plough for the season, $1 - - -	3 50
Tabling and cutting, 4 days, - - -	4 00
Gathering, carting, and packing away, -	2 50
	$28 69

The expense of cultivating one acre is as above $28,69, the labor being rated at $1 00 per day, which is more than the actual cost. The yield was at the rate of 991 lbs. to the acre. If the ground had been fully stocked, the crop would have been more than 1000 lbs per acre. The brush was sold at 8½ cents per lb. The crop of seed was light and poor; at the rate of 50 bushels to 3 acres; and was sold at 16⅔ cents per bushel or $2 77 per acre.

To the above expenses of $28 69 are to be added as follows:

Scraping 1000 lbs. $3 30; board of man 5 days $1 07, - - - - - -	$4 37
Rent of land, 1 acre, - - - - -	16 00
	$49 06
The sales of the above brush 1000 lbs. at 8½ cts. pr. lb. - - - - - -	85 00
Seed upon above acre, - - - - -	2 77
	$87 77
Net profit per acre, - - - - -	$38 71

This product may be deemed unusual; but there is no difficulty under suitable cultivation in obtaining it. The price is not extraordinary; and had the brush in this case been kept until the spring, it would have brought 12½ cents per lb.

Another estimate by a good farmer, is as follows:

Ploughing, $4 00; dragging, $1 00; manure, $12 00; seed, 25 cents, - -	17 25
Planting 2 feet by 3½ feet apart, 75, -	75
First hoeing, $4 68; 2d hoeing, $2 34; 3d hoeing, $1 17, - - - - -	8 19
Gathering brush and scraping seed off,	12 00
	$38 00
Returns.	
700 lbs. of brush at 8 cents, - -	56 00
40 bushels seed at 25 cents, - -	10 00
	$66 00
Net profit per acre,	$27 81

No charge is here made for the rent of the land.

MANURES. STABLE, COW AND HOG YARDS. HUMAN EXCREMENT.

From the same.

The price of manures in this county is very high. The farmers in the vicinity of Boston depend upon the city stables for a large portion of what they use. The price in Boston varies from three to four dollars a cord. I have known a market farmer to purchase one thousand dollars' worth in a year. Since the value of liquid manure is established, and its intrinsic efficacy is so much superior to the solid parts of manure, it is strange that no provision is made by the farmers for saving the vast quantities that are now lost in the city. Hardly an instance can be found, there is not one within my knowledge, of any provision for saving it at their own barns. This is an improvement yet to be effected. I have urged this matter so strongly, though not beyond its importance, in my former reports, that I shall add little more.

I have known $6 50 paid per cord for stable manure taken at the stable; and a farmer, whose soundness of judgment in other matters I have always respected, expressed his willingness to purchase all the manure from the cow-stable in Lowell at five dollars per cord, though he must then cart it four or five miles in order to reach his farm. These prices are enormous, and the more surprising, since almost every farmer in Middlesex has at hand the means of preparing a compost-dressing for his land of equal value, at not half the cost.

Upon the farms in the vicinity very great quantities are carried from the livery-stables in the city. The hog establishment at West Cambridge supplies a large amount of manure to the farmers in its neighborhood. I do not refer in this case exclusively to the excrementitious matter of the swine, but also to the refuse garbage from the stables, of which I have spoken. This is spread upon their grass lands, or ploughed in on their cultivated grounds, or spread round their apple trees; and in every case with great advantage. If not used immediately, it is placed in a compost heap, and covered with mould, to be used when needed. It has been found particularly useful when applied to fruit-trees at the roots. It is of course full of animal matter, and must furnish in abundance the principles of vegetable life. The intelligent farmer who gives me this account speaks of the effects of this manure as immediate and powerful. To night-soil he objects that its influence is transient. He gives the preference over all others to stable and horse manure. He raises largely of early vegetables and small fruits for the market. The stable manure is more convenient for his forcing beds in the spring, and, after it has performed its part there, is easily applied to other crops.

Large amounts of night-soil are obtained in Boston and Charlestown, and applied by the market-gardeners. It is brought out in a crude state in covered and tight wagons, and too often, without regard either to decency or comfort, is carelessly deposited by the road-side near the dwelling-house in a kind of basin, where a quantity of mould is at hand to mix with it, to absorb the liquid parts, and to put the whole into a condition to apply to the soil. The slovenliness with

which these matters are sometimes managed deserves no light censure. I knew a case in which, in the opinion of his physicians, the life of a respectable individual was a sacrifice to one of these negligently managed deposites made by a neighbor in his immediate vicinity. I do not know why, in a civilized community, the public have not an equal right to claim that the air shall not be needlessly corrupted, any more than the wells in a neighborhood poisoned, whether it be by the effluvia of some odious manure-heap or the scarcely less disgusting odors of tobacco. These places of deposite, as matter of public decency, ought never, under any pretence, to be permitted by the highway. By careful management of them in some suitable place on the farm, remote from the road and the dwelling, this great nuisance might be abated.

I am aware upon what a homely subject I have fallen; but I know how essentially it concerns the farmer's interest and the public health. "Evil be to him who evil thinks." I would advise a fastidious reader to pass over this whole chapter, but that I fear if I did, as it happens with forbidden passages in the classics in college, he would think that he owed it to himself to determine on the propriety of such advice, by first reading with increased attention what the chapter contained.

Every advance in cleanliness is an advance in civilization, a contribution to health and an equal help to good morals. The unfortunate beings who live in cities, are doomed to inhale and exhale the innumerable odors, which are there commingled from cellars occasionally filled with bilge-water, muddocks, which the receding tide has left bare, common sewers, and broken gas-pipes. In the country there is no apology for allowing any thing offensive on the premises. The farmers who obtain the night-soil from cities, would find an advantage in digging a long and deep vault, at least four feet in depth, walled up with stone and plastered and floored so as to be made thoroughly tight, and having a close and moveable covering. Into this the contents of the carts should be carefully turned, with such a constant supply of soil or muck or ashes or effete lime or gypsum as would completely absorb the liquid parts, and might be so intimately incorporated with the solid parts as to bring all into a feasible state of application to the land. This vault or stercorary should likewise serve as a place of deposite for all dead animals in the place, and all other offensive matters, which might be converted into manure. The contents of the family vault, being freely mixed with mould or spent tan, should likewise be conveyed there at least once a week. This would be a great gain to comfort and health. I saw much an arrangement on one farm, and its advantages were most obvious. It formed an excellent bank of general deposite, whose discounts in the spring were always most liberal and useful.

The preparation of night-soil for easy use and transportation, has been the subject of various chemical experiments. The prepared article goes under the name of poudrette; and though there have been occasional disappointments, I have seen it used with great success. The admixture of effete or slacked lime with it has the same effect as any other absorbent; but the application of quick lime, while it destroys its offensive odors, expels its ammonia and proportionately reduces its value. Liebig recommends its mixture with gypsum or chloride of calcium, or some mineral acid. I have not known this tried. This would fix the ammonia and give it out to the plants as the vital process is prepared to take it up. The mode of preparing it in Paris, is by drying it in large vats in the sun until it can be reduced to a fine powder and loses all smell. Its best properties are then gone. Fine peat, muck, fine mould, powdered charcoal, tanners' bark burnt and charred, are substances which may be mixed with it to great advantage. It is beyond all question one of the most powerful of manures, but can only be applied advantageously in a prepared state. An establishment for this purpose is about being made in the county which may prove eminently beneficial.

Bone manure has been tried to some extent; in some cases within my knowledge, with great and decided success; in others, without perceptible benefit. These diverse results convince us of our ignorance, and show how much we have to hope from the investigations of chemistry and philosophical experiments in relation both to manures and soils, and the hitherto scarcely approached mysteries of vegetable life. Much of the bone manure which has been used has been from bones which have passed first through the hands of the soap-boiler, and after all the gelatinous parts have been extracted. A considerable portion of their fertilizing properties has thus been taken away. The most successful application of bone manure which I have known was where they were mixed at the rate of about one part to eight with leached ashes or mould, and a fermentation brought on before they were applied. They were then spread lightly in the furrow, where carrots were sown. The effects were most favorable, and surpassed a free dressing of barn manure in the neighboring part of the field to the same kind of crop. I have known this manure applied likewise with great advantage to corn in the hill, a small amount in each hill without other manure, and to turnips in the drill. Peat mud is used with much success by many persons. Its application, when spread directly from the bog upon the soil, has not been approved; but when it has been thoroughly decomposed and reduced by a mixture with stable manure, with ashes, or with quick lime, it has furnished a valuable manure for spreading upon grass ground or putting in the hill with corn.

Various other manures have been used with great success. Ashes are every where commended as excellent for corn and wheat, and likewise for grass. Ashes being the direct result of vegetable combustion, contain of course that which is essential to vegetable growth and life, and being constantly carried from the earth by the removal of its vegetable products, must in some form be returned to it.

In some cases the waste from the cotton mills has been used with much advantage. This consists of that which is thrown out when the cotton passes through the picker, and is made up not only of the wool itself but a considerable amount of the seeds, which are known to abound in oil, and at the south are much valued as a manure. This manure is sometimes spread thinly on grass land, and at other times put into the compost heap. It has been too little employed for us to

determine the best mode of its application. The waste from the woollen mills has likewise been used as a top-dressing for grass both in Tewksbury in this county, and at Northampton in Hampshire. I have seen its effects in these places and in some other parts of the country. They have been most remarkable, and surpassed by no manure which I have ever seen applied. This refuse used formerly to be accumulated in the neighborhood of the woollen factories at Lowell; and being surcharged with oil used in cleansing it, there was great risk always of spontaneous combustion. When thrown into the river it was complained of as interfering with the shad fishery. The amount of wool used at the Middlesex mills in Lowell is more than 600,000 lbs. per year. Being full of animal matter it is a most excellent manure. Its value has long been appreciated in England, but we seem to have come late to the knowledge of it. I have seen it spread directly upon grass land, both in mowing and pasture grounds, with surprising effect. It is much to be desired that the water in which their wools are washed, full as it is of animal oils and alkalies, could likewise be saved and applied to the land. It would prove beyond doubt a most valuable manure either applied on the grass lands or mixed in the compost heap. In the economy of nature nothing is without its use; and the first duty of the farmer is to remember that nothing should be lost.

A very exact and intelligent farmer in Groton made some comparative experiments with different manures on pieces of land contiguous to each other, of which he has favored me with an account. The land to which these different substances were applied was what is there termed reclaimed meadow, and rich in vegetable mould.

One bushel of ashes applied to three square rods of land at the rate of 53 bushels per acre; this produced a heavy burthen of grass, and was considered the best of the several manures applied.

Salt, applied at the rate of one peck to three rods, or fourteen bushels per acre, produced a fair crop, and was considered the next best to the ashes.

Gypsum, sown at the rate of three bushels to the acre, manifestly much improved the crop, and was much the least expensive application. Lime was dry slacked and applied at the rate of one bushel to six rods, or 26 bushels per acre, without any perceivable effect.

I do not present these examples as furnishing any decisive results, but rather with the hope of inducing farmers to make and record exact experiments, though on a very limited scale, that by the accumulation of such facts we may arrive at something more definite. Little can be deduced from the above experiments, unless equal quantities of each kind of manure had been used; and then we want likewise to understand the nature of the soil, as in respect to some soils it is obvious certain kinds of manure are much more suitable than others.

COMPOST MANURE, PRINCIPALLY OF PEAT OR SWAMP MUD (OR MUCK.)

From the same.

D. S. Haggerston, the intelligent and experienced manager of J. P. Cushing's garden and farm at Watertown, has been kind enough to favor me, at my request, with some practical observations and experiments on the subject of manures, which deserve attention, and are therefore subjoined.

"I send you an account of experiments made on the farm of J. P. Cushing, Esq., of the different composts used as manures, and the apparent effects of each.

"Meadow muck or peat has been used in various ways, and found so very beneficial, that two thirds of the manure used on the farm is dug from the swamp.

"A compost for top-dressing mowing land is made from leached barilla ashes from the soap-boilers', and meadow muck, in the following manner. The muck is dug from the swamp, the last part of August, or early in September, and lies one year on the surface, after it is thrown out of the pit. It is then carted to a convenient place to make the compost heaps, which are formed by spreading a layer of muck ten feet wide, eight inches thick, and of any length desired; on the muck four inches of ashes are spread, then another layer of muck, and so on for five layers of each, which makes a pile five feet high, in the form of a ridge. This is to lie through the following winter. As soon as the frost is gone in the spring, the pile is turned over, well broken, and mixed together. It then lies till the October or November following, when it is spread on the land at the rate of fifteen cart-loads to the acre.

"Two accurate trials of the above compost, in comparison with decomposed stable manure, resulted as follows; 4 squares of equal size which are kept as lawns and mown seven or eight times in a season were manured, two with the leached barilla and muck compost, and two with a compost of well-rotted stable manure. It was spread at the rate of twenty cart-loads to the acre. The grass on the different squares was much the same in quantity, but on the squares manured with the muck compost, it was decidedly of a darker and richer color, and the manure introduced a greater quantity of white Dutch clover or honeysuckle. The second trial was in a field mown for hay, 2¼ acres. The field was divided into two equal parts, as near alike as possible, one half manured with muck compost, the other half with rotted manure, at the rate of fifteen cart-loads to the acre. Eight tons and eighty lbs. of hay were cut from the field. No difference could be discovered in the parts manured by the different composts. This proved that, for a top-dressing, the compost of leached barilla and muck is equal to stable manure. After using it to a large extent for several years, I am still in favor of it as a top-dressing. The compost manure, which we use for ploughed land, is made up of two thirds muck, and one third manure. The muck in all cases is mixed with the manure before it ferments, and care is taken not to put in so much muck as to prevent the compost's heating. The fermentation of the manure decomposes the muck rapidly, and I am

convinced the greatest art in the use of muck, as a manure, is to have it in a proper state before it is put upon the land. To dig it from the swamp and apply it before it undergoes a chemical change is undoubtedly injurious. This change is brought on rapidly by hot horse manure or unslacked lime, but with colder substances it requires longer. For mixing with cow manure, or putting in hog sties, it ought to be dug from the swamp, at least six months, and it is better that it should be exposed to a winter's frost, before it is used. The air then, in some measure, effects the change. The action of the manure soon decomposes the fibre in the muck. It falls to pieces like lime, and then has an earthy appearance. In this state, a mixture of one third manure and two thirds muck has never failed with me to produce better crops of all kinds of vegetables than clear manure. For the last five years we have thought it wasteful to use manure without being mixed. Before coming to this strong conclusion of the benefit of muck, when used as a manure, many experiments were made, and universally resulted in favor of muck."

SALTPETRE AS MANURE.

From the same.

Saltpetre has been used to some extent in Middlesex county. The use of this manure and the nitrate of soda, abroad, has, according to the reports which we have had, been productive of so much benefit, that every fact connected with their application here is important. I shall subjoin some few of the results which have come within my knowledge.

E. Phinney of Lexington thus writes to me:

"My experiments with saltpetre as a manure have satisfied me of the inexpediency of using it for that purpose. In the spring of 1839, I purchased 400 lbs., for which I paid $8 per cwt. I tried it upon wheat, rye, and grass. Fifty pounds to the acre on wheat and rye had no perceptible effect, and on grass but very little. One hundred pounds to the acre occasioned a very considerable increase of straw and grain, both in wheat and rye as well as grass. But had I bestowed an equal outlay in compost made from peat-mud and stable manure, or peat-mud and ashes, I have no doubt the immediate crop would have been more benefited and the land have received more permanent improvement. I have in one instance seen very striking effects produced by the use of saltpetre upon a light, sandy soil. But the quantity used I could not learn, any further than that it was much greater than the quantity to the acre used by me. I believe a portion of saltpetre and common salt, say ten pounds of the former and twenty pounds of the latter to a cord of compost manure well mixed, would greatly improve it. The beneficial effects of saltpetre in the destruction of insects that annoy our crops, cannot be doubted. I noticed on the farm of Mr. Whipple, of Lowell, two orchards separated only by a stone wall. The trees upon one side of the wall were badly eaten and almost destroyed by canker-worms, while those upon the other side were untouched. On inquiring the cause, I learned that saltpetre had been used upon the land of the latter orchard and none upon the former. The remedy may be an expensive one; but were my trees attacked by this terrible scourge, I should immediately apply it. The saltpetre, instead of injuring the trees, as most applications do which are made for this object, would greatly promote their growth."

I think proper to subjoin here, though from another county, the experiment of John E. Howard, of West Bridgewater, Plymouth county, an account of which he was kind enough at my request to furnish me. Mr. Howard's exactness and intelligence are well known.

"You expressed a wish to hear further concerning the experiment which I made the past season, to test the efficacy of saltpetre, when applied as a top-dressing to grass land.

"Of the patch selected the soil is a light sandy loam. On this, some time in the latter part of May last, I sowed saltpetre at the rate of one pound to the square rod. The effects were soon visible; the grass exhibiting a deeper shade and a more luxuriant growth than in any other part of the lot. It continued to grow thriftily until the period of its maturity, when, on cutting it, the produce was judged to be double that grown on any equal number of feet in the same field. The beneficial action of this substance, however, seems not to have extended beyond the first crop; as, since that was removed, no appearance of superior fertility has marked the spot where it was spread."

O. M. Whipple, of Lowell, the proprietor of a large establishment for the manufacture of gunpowder, in which much of this material is used, has favored me with successive communications on this subject, which I can do no better than present in his own language.

"It is now about sixteen years since I commenced using saltpetre. The grounds upon which I have used it, have yielded large crops, and have held out much longer than grounds in general, of the same quality of soil, and of the same kind and quality of dressing commonly used.

The kind of saltpetre which I have used has been that part extracted from the common saltpetre while undergoing the process of purification, and is not fit for gunpowder. I have, therefore, not been particular as to quantity, using what I have had to spare; but I am satisfied that it requires but a very small quantity to produce favorable results; I have thought that one hundred and fifty pounds per acre would be a sufficient quantity to be used generally. The best mode of using it is to mix it with barn manure, meadow mud or any kind of compost which may be at hand; although I have used it in various other ways, as I shall now describe.

I have one piece of ground of 2¾ acres. It had been used for a long time as mowing ground, and had, as it is termed, run out, and grew but a very small crop of grass, say 1500 lbs. to the acre, I ploughed it in the fall of 1830; in the spring of 1831, I covered it with barn manure, mixed with saltpetre, as described above, and harrowed it in, and planted corn without disturbing the furrows. I had a very handsome crop of corn. In the spring of 1832 I again dressed it as before, that is, with barn manure and saltpetre, sowed oats and stocked it down. The oats were

good. In 1833, I took from it a crop of grass, which was estimated to be six tons. It has grown grass every year since, and I believe not a less quantity than the estimate above has been taken from it since the first crop. I should be safe in saying that there were six tons grown upon the lot the last year, and this year the crop is good. I have another lot, containing 1¾ acres, which like the other yielded little grass; 20 cwt. being all the lot produced in 1822. In the spring of 1824, I dressed it upon the surface with manure, meadow mud, and saltpetre mixed; and it yielded a moderate crop that year. In the spring of 1825, I sowed upon the surface, as you would sow rye, a quantity of saltpetre. The result was, that I took from the lot at least four tons of hay, as it was adjudged. This too was in a lot containing apple-trees, and the grass much lodged all over the field. I continued sowing upon this lot a small quantity of saltpetre once in two years, for five or six years, and at the same time raising a very large crop of grass yearly. Nothing has been done to this lot for the last six years, and there is at this time upon it more than a middling crop of grass.

"I have another lot of light-soiled ground, of about four acres; it had been used for growing rye. It occurred to me that I would try the experiment of saltpetre upon a small piece of this ground. The result was so favorable, that the next year, in the spring, I covered the piece with meadow mud mixed with saltpetre. The result was, that I obtained from the ground as large a crop of grass as it was considered profitable to raise. Last year, which was the fifth, it yielded two tons per acre. There has been, however, a small quantity of saltpetre sowed upon the lot since. I could describe other lots upon which saltpetre has been used, but with the same results as those already mentioned.

"I shall now designate the above lots and describe the kind of soil.

"The first is No. 1, of a middling quality, neither very wet nor dry.

"The second, No. 2, is an orchard adjoining Concord river, of a damp soil and of a very good quality.

"The third is No. 3, a dry, sandy soil, considered by me of no value, until I practised using saltpetre upon it as a dressing. With regard to the mode or manner of using saltpetre upon ground, I do not think it makes much difference, if it is but put upon the ground. I have practised sowing it upon the surface, and mixing and ploughing it in with, for aught I know, equal results; but I should be rather in favor of mixing and ploughing it in. In this case it would require a larger quantity, say 300 lbs. per acre; the effects would be more slow and lasting. In sowing upon the surface, it would require a less quantity, say 150 lbs.; but it would be necessary to repeat the dressing yearly, until the crop should be satisfactorily large. I am more in favor of bringing up the ground gradually, by the yearly application of a small quantity of saltpetre, than I should be by a larger quantity, and getting a large crop the first year."

Since the foregoing, the same farmer has furnished me with some additional information, which follows; and again, the present year, assures me of his continued success in this application. I could have wished that the experiments had been made with more exactness.

"Since my communication to you in June last, respecting the use of saltpetre as a manure, I have had a more particular practical demonstration of its utility.

"Having an island in Boston harbor, called Spectacle island, and its distance from land rendering it very expensive to furnish manure for it, in the spring of 1838 I concluded to try the experiment of using saltpetre as a substitute, and in order to test its ability with some exactness, out of two acres which had been cultivated the year before, half an acre was set apart for the purpose of receiving 150 lbs. saltpetre, which were sowed on the surface and the whole two acres were then ploughed and planted with potatoes. At harvesting, I found that there was an increased crop upon the ground where the saltpetre had been applied. I directed the man in charge to dry 5 hills upon the ground where the saltpetre had been applied, and also 5 hills where there had been no saltpetre, and weigh each parcel. The potatoes on the ground where the saltpetre was applied, weighed 9 lbs., the other 4 lbs. This, it will be perceived, was the result of one year's application only. I am inclined to think that its influence will be felt more or less the second, or even the third and fourth years.

A field containing two acres from which grass had been taken for 8 years, I had ploughed in the spring of 1838, once only; it was ploughed deep, and 90 rods were appropriated to the growth of ruta-baga. The seed was sown upon the tops of the furrows, without any manure in the drill, and the result was, that I obtained 500 bushels of the article specified above; the remainder of the field was sown to oats, but the crop was mostly destroyed by the unexampled growth of hog weed. This field had been wholly sustained by the application of saltpetre upon its surface, previously to its being ploughed, excepting at the time of ploughing, when there was turned in a small coat of manure."

WHITE HOGS.

From the Farmers' Cabinet.

Mr. Editor—It is really amusing to find that many of our friends are beginning already to *turn up their noses* at the black Albany Berkshires, and express a strong preference for Mr. A. B. Allen's white *Kenilworths*, wondering if that gentleman will have a sufficient supply for all his customers the next season? And I have heard some apologizing for having gone into the black Albany breed, by declaring they *never liked them*, always having had a strong prejudice for a white hog—and so we go on. But I suspect the *Kenilworth* harvest will not be so profitable as has been the Berkshires, for nothing will be more easy than to compete with the Kenilworths by means of our own Chester and Delaware county white breeds; and I am sanguine in the belief that we shall be able to convince all disinterested persons, that so far as that distinct breed is concerned, our intelligent friend Allen might just as well have remained at home; and of this he might convince himself, by taking a journey to these parts, at a com-

paratively trifling sacrifice of time and money. And I take the opportunity of introducing to the notice of those who, having tried the Albany Berkshires, and found them wanting, a breed of hogs now in the hands of Mr. William Reybold, Delaware state, which, or I am much mistaken, will not be found at all inferior to the imported Kenilworths, if they be not much superior, as I strongly suspect they will prove. They are perfectly white, too, and soft-haired, with the deep side of the old tawny Berkshire, cutting up nearly as thick in the side and belly as on the back, which is, I guess, about as much of an *antipode* to the black Albany, as the color of the breed. Mr. W. Reybold is the son of Major Philip Reybold, the breeder and feeder of those superlative Leicester sheep which were slaughtered at Baltimore the last season, several of which weighed over 40 lbs. a quarter, dead weight, at the age of two years; and Mr. Allen would find that the major's present stock of fat wethers would vie with any of the thoroughbred varieties in England, of any name or county. And I cannot but suspect, from the perusal of Mr. Allen's letter, that the time *has come* when we may take our stand and breed from our own stock, without being beholden for any more help from abroad; for indeed it is curious to observe how very small have been the importations by this first of breeders and judges of stock, which, as far as I can learn from his letter, amount to *five* pigs of the Kenilworth breed, "three of them from a smaller and coarser boar, and from sows still less!" But what our friend means by stating that "he was informed this was always the case with this breed," I am at a loss to conjecture. It might disclose my ignorance, perhaps, were I to ask, if this admission be meant as a recommendation or otherwise, of this particular breed? To these are to be added the number of Berkshires brought, which is not stated in his letter; the sheep for Mr. Rotch, Mr. Stevenson, and Bishop Mead; one dog, of a sort which requires *no instruction* to break into the management and care of a flock—which no one will believe who knows any thing about the matter—a few Dorking fowls, with extra toes to their heels, sometimes attaining to the *great* weight, when fatted, of 8 pounds—and a few pheasants! Of short-horns he brought none, and confesses that it pains him to see so many Durhams of ordinary quality imported; and as for horses, "England ought to come to us!" What, for carriage horses, the present racing blood, and the high-bred hunters? Try again, friend Allen.

On the subject of the Dorking fowls, I would just say, if Mr. Allen had come on to Jersey state, he would have found that Mr. Wood, of Haddonfield house, could "beat that hollow," not sometimes, but always, many of his chickens weighing more by a couple of pounds than the great weight he mentions. He is in error in the statement that the game cock of England is from a cross with the pheasant; if he had seen any of that particular cross, he would have known better. If I could say what I wish on the subject of the travels of our eastern friends, without fear of offence, I would just hint the probability of their being more gratified, and of reaping more wisdom as well as profit, by going abroad in their own country, rather than by visiting foreign lands in the expectation of speculating in stock, a very precarious business at best. Mr. Allen complains of the enormous expense of shipping animals from England. I fear if his expenses of travel were to be spread over the few animals which he has brought over, the account would deter many from making the experiment in future. I wish that we could for once come down to the improvement of our breeds of cattle without the vile spirit of speculating for money; but that has been our easily-besetting sin, from the time of the Merino-mania to that of the multicaulis and the black Albany Berkshire fever. "All wrong, depend upon it."

I have heard that when John Lossing found that A. B. Allen had gone to England to import big Berkshires, he had the precaution to sell out his Albany Berkshires, making a profitable speculation of it. That was wise; for he may now either go back to the breed by which he has made thousands of dollars, or *forward*, into the Kenilworth; and as he knows so well how to "strike the iron while 'tis hot," he may make capital stock by commencing with such hogs as those described by Homer Eachus, at p. 329 of the Cabinet, vol. v., which might be denominated the improved-improved Kenilworth white Berkshires; he will not be at a loss for individual names, for there may as well be $300 *white* Maximas, as black ones; but he had best be quick about it, for in this part of the country, where that breed has long been known and properly appreciated, persons may be found who will "hit the right nail upon the head," and go into the business at once.

G. H. D.

Chester county.

BUTTER.

From the Halifax Colonial Farmer.

The Low Dutch inhabitants of Long Island were accustomed to churn their milk instead of the cream, as habit had taught them to prefer buttermilk to sweet skimmed milk. They consequently churned every day; the morning and evening's milk was put into a very large and very clean churn which was placed near the fire, and securely covered, always putting to it a small quantity of coagulated milk. As soon as the milk was all coagulated, which it generally was by nine o'clock the next morning, it was carried to the milk-room and emptied into the churning churn, adding one third the quantity of warm water. The woman churned with her foot, as she was accustomed to turn her flax-wheel, the dasher being lifted by a spring-pole, such as is affixed to the most simple kind of turning lathe. While churning, she was always knitting, for a Dutch woman will never lose any of her time. The churning was generally completed in half an hour, the buttermilk was then strained off, and the butter turned into a tray; then taking a large wooden ladle with a handle about half a yard long in each hand, she took up in the ladle in her right hand about a pound of butter, which she tossed up five or six feet high, catching it with her ladle as it fell, two or three times; and then with a smart stroke at arms' length, struck it into the ladle in her left hand, when after changing hands, and tossing and catching it again, she deposited it in a tray previously rubbed with fine salt, and com-

menced with another lump. This work is performed with remarkable agility even by old women. I think that I have seen a woman of sixty work the buttermilk out of ten pounds of butter in this way in less than five minutes? The butter is then cut to pieces with the edge of the ladle, the proper quantity of salt taken up in a horn spoon and sprinkled over it, and worked into it by chopping, tossing and catching and striking it from ladle to ladle (for a Dutch woman never touches butter with her fingers.) She then with the ladle places in a balanced plate in her scales the quantity she means to have in a print, and when it is weighed, gives it a neat figure by tossing and catching it, and then with a smart stroke of her paddle brings it upon the print which is held in the left hand, having a long handle like the ladle.

As we have some of the descendants of the Low Dutch in the county of Annapolis, it is to be hoped that they retain the ancient practices of their mothers, who were well qualified to give useful lessons to many of our countrywomen upon other parts of housewifery as well as upon managing the dairy.

Many women who make good butter have the custom of skimming their milk the same morning that they churn, and mixing the cream with that which they are about to churn. This cream is left in the buttermilk, for it will not make butter till it becomes sour. Of this any persons who follow this practice may convince themselves by allowing their buttermilk to stand twenty-four hours and then churning it again.

When the strippings (the last milk taken, after three-fourths or more have been milked) are mixed with the cream, it should be allowed to coagulate before it is churned, or else a part of the butter will be left in the buttermilk. The stripping or last milk, and the first cream that rises, make the best butter. The salt used for butter should be of the best quality. That which turns damp in wet weather is not fit to salt either butter or pork. This dampness is caused by muriate of lime, a salt of which there is a small quantity in sea-water; it will attract an extraordinary quantity of water from the atmosphere, and always weaken the brine in which it is mixed.—When good salt cannot be procured, the damp salt may be freed from the muriate by the following process: make a strong brine with some of the salt, let the salt that is to be refined be put into this brine for a day, stirring it occasionally; then pour off the brine, put clean water to the salt, stir it for a few seconds, pour it off and dry the salt in the sun. To make this process intelligible, it should be observed that brine so strong that it can dissolve no more common salt, is still capable of dissolving a considerable quantity of muriate of lime.

To make good butter from milk of thin ridge-backed cows in hot weather, the milk should be scalded as soon as it is strained; the cream will then rise as thick as that of muscular broad-backed cattle, and make nearly as good butter, and the churning may be performed in less than half an hour. Care should be used that the milk is neither burnt or smoked; for this reason the pot should be set on coals, and not allowed to boil.

One part sugar, one nitre, and two good salt, will preserve butter, almost unchanged for a long time; but the butter must not have been washed with water, and when packed it must be secured from the air by covering it with a cloth dipped in melted butter, the edge of which must be soldered to the tub or crock with melted butter.

Charcoal if it could be used without difficulty has a more powerful effect in preserving butter than any kind of salt. When a boy I had occasion to see many firkins of Irish butter opened which had been kept long in stores. A part of the casks were burnt to a coal on the inside. In all these the butter was perfectly sweet; in all those that were not burnt, it was very much damaged.

THE AGE OF CATTLE AS SHOWN BY THEIR TEETH.

From the Kentucky Farmer.

My attention has been drawn to this subject ever since our Winchester fair. One of the judges appointed upon that occasion examined the teeth of several of the cattle that were presented there, and pronounced them to be older than represented.

Some of these cattle were bred in this country, and *I know* that their ages were correctly stated.

At Paris, the treatise upon cattle with the plates was introduced by one of the judges, and the teeth of some of the animals were examined to see if they corresponded. This led to suspicion that there had been imposition in some of the cattle presented.

Since that time I have examined the teeth of a number of thorough-bred Durhams whose ages I know to a day, and have found that in this stock their teeth would make them appear to be about four months in each year older than they really are. A three year old will have the teeth that in the treatise upon British cattle is said to belong to a four year old.

I attribute this to the early maturity of the Durham stock. It is reasonable to suppose if they get their growth sooner than other cattle that they will also shed their teeth sooner. I have said about four months to the year, which was the case generally. Some showed even a greater difference.

SAMUEL D. MARTIN.

BERKSHIRES.

From the Farmers' Cabinet.

Mr. Editor:—So much has been said and written about the Berkshire hogs, that people have procured them, at a heavy price, merely because they have been highly recommended in the agricultural papers of the day, and because it has become fashionable to have them, so that when a friend drops in, why, if you have nothing else to show, you must fain show your Berkshires. Now, what I am going to say will no doubt raise the hue and cry of the whole fraternity of Berkshire breeders. Yet I care not: what I seek are facts, and these must be told, and cannot be controverted. I am a subscriber to your valuable

paper, and as such, I have always been pleased to see that your columns are open to a temperate discussion of matters and things, even when men do differ, and this fact is the cause of my troubling you for the first time with my observations. This is, however, digression. In the first place, then, the Berkshire hogs are not what they have been "cracked up to be." I have a neighbor, who has given them a fair trial, to which I have been an eye-witness. The experiment was made in this way:—two Berkshires were placed in a stable with two of the common breed, all of the same age, and were carefully fed, and at the end of nine months they were killed, and the result was, that the common breed exceeded the Berkshires in weight, one fifty and the other sixty pounds. Experiments have been made, to my knowledge, in other instances, with similar results, and even with worse credit to the far-famed Berkshires. They are not prolific: a gentleman of my acquaintance had four sows, each of which had but *one pig*, being a loss of at least ten per cent. a head, and the generality of them, I believe, do not get more than four or five. The only redeeming quality which they possess is, that they fatten easier and quicker than some breeds of the native hog; but even this is counterbalanced by their diminished weight when slaughtered. They may be considered an improvement on the common China hog, and that is about all. I have a number of common hogs in a pen for killing, which are but nine months old, but they will weigh 300 pounds a-piece by Christmas; they have been fed on nothing but the offal of a kitchen, and a run at grass, until within about four weeks, since which they have been fed on corn and boiled potatoes. Considering their feed—for after all that makes the hog—these hogs of mine will challenge competition with any Berkshires in the land, for symmetry, heavy hams, finely turned shoulders, thick and deep in the sides, &c., &c. I purchased them when small, but not being aware of their qualities, I did not preserve the breed; I shall, however, endeavor to get others, and by a judicious crossing, I have no doubt they will make a far superior hog to the Berkshire, which a number of my neighbors have given up, preferring the best of the common kind to them, and in so doing, I think they are perfectly right. I have no disposition to discourage the propagation of a superior breed of animals; on the contrary, I would do all in my power to further so laudable an object; but the Berkshire pig mania, like the mulberry speculation, is upon the wane, and if A. B. Allen, of Buffalo, New York, has in his late trip to England, brought no better specimen of improved animals than Berkshire hogs, he might have saved himself the risk of a ducking in the Atlantic for such an object.

R. S. B.

Hanover township, Northampton Co., Pa., Dec. 5, 1841.

AGRICULTURE VERSUS COMMERCE.

From the Farmers' Cabinet.

Mr. Editor:—On reading the article of your city crrespondent, G. M., in the last number of the Cabinet, I have been led to the conclusion that the writer is either an extravagant liver, or that mercantile business is not what it has been "cracked up to be." He informs us that he invested $15,000 in the year 1827 in commercial business, and has been considered ever since a *successful* merchant, and that for the fifteen years he has been in business, his living has consumed all the profits, and that he is now not worth more than when he began, if so much.

Now, if that living which has absorbed all the profits of a business with a clear capital of $15,000 has been an economical one, I should say that the sooner the capital is diverted to another channel of industry, the better; and as your correspondent wishes to escape the reverses incident to his present business, and seems desirous to turn his attention to the independent and noble pursuit of agriculture, for which he is prepared, at least in *capital and theory*, I would, therefore, for his information, and that of like inquirers, contrast his mercantile operations, and the results as given by himself, with the agricultural operations of my neighbor, S. G., and their happy results worked out, through an experience of 17 years, on land that in this section of the country is considered *naturally* third rate. Mr. G., by close application for some years to a mechanical trade, and at the same time living economically, accumulated a considerable sum, with which he purchased a poor farm of about 130 acres, and the *necessary* stock for the same, which consisted of a yoke of oxen, a horse, and two cows. In conveying an idea of the condition of this farm, I could not use language more significant than that used by Mr. G., when speaking on the subject of his commencement in farming. He stated, that his farm was *so poor* when he purchased it, which was in the spring of 1824, that "he did not believe that his two cows, pair of oxen and horse, got a belly-full of grass on the farm the first summer." This poor land cost him 30 dollars per acre; his stock and farming utensils amounted, perhaps, to about $400; this will increase the investment to $4300. The farm-stock and utensils, he informed me, "he had *about clear*." The first year he put on this worn out land 2000 bushels of lime, and the manure made in the yard the preceding winter, which was carted out with a yoke of oxen in less than a day. This lime was spread on the land at the rate of 100 bushels to 3 acres, or 33⅓ bushels to the acre; and from an experience of 17 years, he finds that a top-dressing of about that quantity repeated every five years, keeps the land in a better condition than when put on in larger quantities at more distant periods. But this experience, it may be remarked, has been altogether confined to the treatment of *mica slate land*. The lime acted with magical effect. The manure-heaps, (the farmer's gold mine,) which in the fall of 1824 had been *quarried* out, and carted on the land with a yoke of oxen in less than a day, increased, until double that power was required from ten days to two weeks to remove it from the yards and stables. The capacity of the farm to support animal life consequently increased; and in a little time Mr. G. stood by the side of his more favored neighbors as a respectable farmer, no more to receive the jocular expressions of "poor farm," "starved stock;" and the thousand and one mortifying thrusts of home-spun wit and neighborly jest. Actuated by the right agricultural spirit, he has continued his

excellent treatment of repeated liming and manuring, until he has brought his farm into a state of improvement for grazing, and indeed for any other purpose, equal, perhaps, to the best land in the country. He has fed this year upwards of 40 head of cattle; and as an evidence of the capacity of his farm to produce grain, his field of corn, containing about ten acres, averaged about 85 bushels of shelled corn to the acre. In speaking of the powerful effects of lime as a fertillizer, Mr. G. made the remark that "*if lime put a man in jail, it would soon take him out again.*" Thus conveying a good deal in favor of that valuable mineral in a few words. But is it saying too much? Every experienced agriculturist in this section of country, I am inclined to think, will unite in opinion with my neighbor G.; and I believe that if the truth conveyed in the remark were impressed more generally, we should find through the country more good land, and hear less complaint of hard times. We now have the case presented, of an investment of $4300 in agriculture, and a successful and judicious pursuit of the same for 17 years; and what is the result? First, a good living for a large family. Second, an increase of the value of the farm from $30 per acre to $90 per acre. Third an increase in the value of stock and farming utensils, from $400 to from $1000 to $1200. Fourth, several thousand dollars at interest, as profit from the farm on good security—not bank stock—besides suitable marriage portions to several of his children. I have now drawn the contrast, and without comment, would conclude by observing that Mr. G. is worth from $15,000 to $20,000, without a creditor; and is now enjoying his *otium cum dignitate* in the character of "Gentleman Farmer."

POA VIRIDIS.

Goshen, Chester county, Dec. 9th, 1841.

HINTS ON POISONS.

By Thomas D. Mitchell, M. D., Professor of Materia Medica and Therapeautics in the Medical Department of Transylvania University.

From the Kentucky Farmer.

Lexington, Ky., January 4th, 1841.

Dear sir:—Hoping that the hints and facts herewith communicated, may lead to further and more stable conclusions on the subject of *milk sickness*, than any that have yet been formed, I extract them from a manuscript work on *poisons*, in which I have been for some time engaged. You will perceive that they have no claims to methodical arrangement, and have not the charm of novelty to commend them to public notice.

That milk may be poisoned, even without criminal design, is now well understood. The milk pans in use in Europe, and to some extent in this country, have often imparted a deleterious quality to cream, and consequently to butter. Many facts directly in point could be cited from the best authorities.

But the most fruitful source of injury to milk is that agent, whatever it be, that gives rise to the disease so common to the western country, and called *milk sickness.* This unexplained source of mischief has perplexed not only the common people, but men of science, all over our own country, and not less the learned and unlearned of Europe. Hence, the inaugural dissertations, that have been repeatedly written by candidates for graduation in medicine, the numerous essays of practising physicians, in various sections of the union, and the elaborate disquisitions of eminent Germans and Frenchmen, on this recondite question. And yet, the darkness that envelopes it is dense as ever; and we see not that science promises much to dissipate the gloom.

Christison justly remarks, as others had done before, "that the milk of the cow, the ewe and the goat, may act like a virulent poison, although no mineral or other deleterious impregnation could be detected in it; and these effects have been vaguely and variously ascribed to the animal having been diseased, or to its having been fed on acrid vegetables, which enter the milk without injuring the animal, necessarily." And Orfila, to whom in conjunction with Mare was entrusted the examination of goat's milk that had proved poisonous to many persons, reported, "that no mineral poison could be detected; that none of the usual explanations were satisfactory, and that the *poisonous change in the milk should be ascribed to new principles, formed or developed by a vital process.*"

The conclusions just stated are, it may be, correct; yet there is reason to believe that the poison may be derived from some kind of vegetable matter, which could not be detected by chemical tests. Dr. Westrumb, who wrote on the poison of cheese, held this opinion; and conjectured that the milk was poisoned by the cattle partaking of a species of spurge, (*Euphorbia esula,*) which, agreeably to Viridet, caused certain fields in the neighborhood of Embrim to be abandoned by the shepherds, because it rendered the cows' milk useless. The same writer also observes, "that the cows would not touch this plant so long as wholesome pasture was within their range."

The symptoms, in the cases already referred to, as having occurred in France, were those often seen in violent cholera. At Hereford Westphalia, where, according to *Rust's Magazine,* for 1828, a woman and her 5 children were poisoned with goat's buttermilk, sent to them by a charitable neighbor, the symptoms were violent puking, dilated pupils, the eye-lids half closed, pulse small, hard and slow, epigastrium turned, abdomen contracted, bowels unmoved. These, as will be seen, were not unlike the symptoms of milk sickness, in this country. Lukewarm water was given, to increase the vomiting, after which two ounces of medicated soap, dissolved in a pint of water, with the addition of an ounce of almond syrup, were administered, and the bodies of the patients were washed with vinegar and spirits. In ten hours, all the patients were recovered.

The most careful examination of a portion of the buttermilk that had poisoned the family, failed to detect any trace of mineral poison; and the physician attributed the mischief to some narcotic herb, probably the *Ethusa cynapium,* or fool's parsley.

I have been at some pains to compare a thesis, written by Dr. Read, of Ohio, who graduated at the Medical College of Ohio, in 1832, with another thesis, written by Dr. Simpson, of Kentucky, who graduated at Transylvania University, in

1839. Both treat of *milk sickness*, and although entirely unknown to each other, their statements, professedly drawn from personal experience and actual observation, very closely agree. Both assign the deleterious agent in milk to some vegetable consumed by the cows, in *new* lands; and they testify that the effect fails when the lands have long been under cultivation. This statement accords with the great mass of evidence throughout the world, where the phenomena have been noticed. Dr. Simpson and others object to the *miasmatic doctrine*, contended for by some, in accounting for milk sickness, because, as they allege, if cattle be placed on two distant fields on the same farm, the one subject to cultivation for several years, the other in a wild state, and full of native vegetation, those in the latter will be sickened, while those in the former will retain their accustomed health, although both be precisely alike as to the influence of the usual sources of miasmatic exhalations.

In 1833, two citizens of Kentucky came to Cincinnati, anxiously seeking the cause of a terrible devastation among cattle, and human beings, in their neighborhood, which they supposed could be detected in the water, of which the animals and others drank. They handed me a jug full of the water, which was perfectly limpid, insipid, inodorous, and without sediment. The disease complained of was the *milk sickness*, and the water was imagined to be poisoned with arsenic, in some way or other. Yet, it was not possible to detect any sort of poisonous matter; in fact, the water was of the purest kind. I gave it as my opinion then, and still believe, that the milk had been deteriorated by some unknown and not discoverable agent, belonging to the vegetable kingdom. When I say "not discoverable," I refer to the action of tests, for I fondly hope that the source of this poison is yet to be ascertained.

Cheese.—For many years it has been known that cheese, owing to some unusual quality, exerted occasionally a poisonous influence. In the German journals, may be found several very interesting papers on this subject, and they go to confirm the statements so often made in this country, on the same point.

It has happened, that, of a whole cask of cheese received from a given cheesemonger, only one has evinced any poisonous properties, and that had no obvious peculiarity about it, in color, consistence or taste.

The symptoms develope themselves according to the quantity eaten, commencing in from 10 to 15 hours, but deferred, now and then, to a more remote period after the noxious meal. The first notes of distress are, pain in the stomach, vomiting, purging, and dryness of the mouth and nose. The eyes, eyelids and pupils become fixed and motionless; the voice grows hoarse, or fails entirely; the power of swallowing is impaired, the pulse gradually flags, swoonings occur, and the skin is cold and insensible. The secretions and excretions, excepting the urine, are suspended, but sometimes there is a profuse diarrhœa. The appetite is not affected, there is little or no fever, and the mind is unclouded. Fatal cases end with convulsions and laborious breathing, as early as the third, and as late as the eighth day. If the patient recover, he feels badly for weeks, and sometimes never regains his wonted vigor.

The symptoms mark this substance, as belonging to the *irritant* poisons, although, secondarily, it would seem to merit a place among the *narcotico-acrids*.

The *morbid appearances* are, inflammation of the mucous membrane of the stomach and bowels, whiteness and dryness of the throat, flaccidity of the heart, and a strong tendency to resist putrefaction.

That cheese is sometimes poisoned with red lead, that is present in the annato employed to color it, cannot be doubted. Mr. Wright has furnished a good paper on this subject in the Repository of Arts, vol. 8th, page 262. It presents undoubted proof of the poisonous action of some fine looking Gloucester cheese, in which the red oxide of lead was easily detected, by a neighboring chemist. Samples of the annato employed as a coloring for the cheese, were found to be strongly impregnated with the lead. This very dangerous sophistication can be readily detected, by macerating a portion of the suspected cheese in water impregnated with sulphureted hydrogen gas, acidulated with muriatic acid. A brown or blackish color is instantly struck, if the minutest portion of lead be present.

But the most embarrassing cases of cheese poisoning are those in which the ordinary tests fail to discover any evidence of poisonous adulteration. These are of frequent occurrence. About 12 years ago, a large number of persons sickened, after eating of a fine looking and well tasted cheese, which was one of a cask, more than half of which had been sold in the same village. There was no fatal case, but some persons were made extremely sick and suffered great gastric and intestinal distress. I was requested to make an examination of the cheese, and portions were sent to others, for the same object. After a careful research, no poison could be detected by the ordinary means, and we came to the conclusion, that the source of the evil must have been derived from some vegetable matter, eaten by the cows.

The inquiries of Serturner and others go to make it probable, that the poisonous property of cheese often depends on two animal acids, analogous to, if not identical with the caseic and sebacic acids, which we know to be, chiefly, the source of evil in poisonous sausages. It is certain that caseic acid, obtained from cheese, will destroy the smaller animals very promptly, and that the sebacic is even more rapidly fatal.

I feel confident that not a little of the cheese that induces poisonous effects, owes its pernicious quality to the same, or to a similar vegetable matter, that is generally regarded as the cause of *milk sickness*, in new countries. If the milk and the cow that yields it, may be poisoned, as they certainly are, what can prevent butter and cheese made from such milk, from sharing in the evil?

Fatty matters.—By some process, not by any means understood, certain animal matters are so changed, although their exterior may appear as usual, that the eating of them gives rise to very distressing symptoms, and sometimes causes death. Some have supposed, that there is carried on, silently and imperceptibly, a modified putrefaction, which changes the quality, without affecting the form or apparent condition. The articles, most usually altered in this or in some other way, are *sausages, lard, pork* or *bacon*, and *butter*.

The *poison of sausages* has become so notorious, in some parts of Europe, as to have been the subject of a thesis, a prize essay, and other papers. In the Wirtemberg territories, in Germany, we are assured that 234 cases of this kind of poisoning occurred in about 34 years; of which number, 110 proved fatal. In the winter and spring of 1834, similar cases occurred in the neighborhood of the Black Forest, in the territories above named. The symptoms are reported to have been very alarming, and several individuals died. The food eaten by these persons was the sausage of the country, and liver puddings. The former were reduced to a pulp in the centre, were very bitter and rancid, and smelled like cheese. The puddings had been evidently decomposed, as they were quite sour. The remedies found most successful in these cases, were immediate vomiting, a purgative draught of Glauber's salt, and clysters of vinegar and soap.

It is stated by various writers, that the symptoms of sausage-poisoning do not begin until twenty-four hours after the noxious meal has been taken. This is said to be owing to the great indigestibility of the fatty matter, which enters the food. Pain in the stomach, vomiting, purging, dryness of the mouth and nose, are usually the first symptoms. The eyes and eyelids, and next the puplis become fixed and motionless; the voice fails or is entirely lost; deglutition is difficult; the pulse gradually sinks, frequent swoonings come on, and the skin becomes cold and insensible. The bowels are sometimes torpid, at others the very reverse. The appetite is not impaired; there is little or no fever, and the mind maintains its usual tone. Fatal cases end with convulsions and great difficulty of respiration, between the third and eighth days. Such is the shock imparted to the system that even in successfully treated cases, the effects are felt for years.

The *morbid appearances*, in the dead body, are inflammation of the mucous membrance of the stomach and bowels, whiteness and dryness of the throat, thickening of the gullet, croupy deposition in the windpipe, great flaccidity of the heart, and a morbid tendency to resist putrefaction.

What is the nature of the change effected in the sausage, no one has been able to reveal. It has been asserted, that the poisonous principle resides in a fatty acid, called by *Buckner* the *Botulinic* acid. Experiments with this acid, as obtained from the spoiled or poisonous sausage, showed the same results as are witnessed in animals that partake of the sausage itself.

In regard to the poisonous quality of *lard*, under peculiar circumstances, we have little to say, that is satisfactory. Mere rancidity does not seriously affect it. Keeping it in copper or cedar vessels, may render it more or less deleterious.

In the winter of 1838-9. I saw a portion of lard, sent to Professor Peter, for examination, in consequence of having sickened those who partook of it, in any shape. Some were affected pretty severely, though no one died. The lard looked as well as usual, and had no particular smell nor taste. The examination failed to detect any thing of a poisonous nature. It is quite possible, that lard may be poisoned by the empyreumatic oil, resulting from the application of a strong heat to a small portion of it. It is known that this oil, as produced by the destructive distillation of lard, is decidedly poisonous. Five drops, passed into the throat of a bird, nearly killed it.

Pork, in the fresh, as well as the cured state, under the name of *ham*, *bacon*, &c., has often evinced poisonous properties. I am of opinion, that some of the cases of poisoning, as they are termed, by fresh pork, were dependent on other causes. In the summer season, when green or ripe fruit is freely indulged in, almost any kind of fresh meat, not well seasoned, will derange the digestive apparatus, and it has frequently occurred, that true and fatal cholera morbus has resulted from such imprudence.

In the *Philadelphia Medical Examiner*, for Jan. 1839, we have a short paper headed, "poisoning from *pork*," furnished by a physician of Illinois. The patient died, it is true; but he had been laboring for months under gastro-enteritis, was frequently attacked with colic, and often much disturbed by any sort of food that did not suit his condition. Under these circumstances, fresh pork was freely eaten, and soon after, a quantity of grapes, and the man died in nine hours after the commencement of the attack, which did not begin until the day after the pork meal.

I will not say, however, that young pork may not acquire a *poisonous* quality, and kill, as the consequence; but the cases that I have met with, are not satisfactory.

In reference to ham, and all kinds of bacon, the evidence of occasional poisoning is conclusive. This may be the result of very different causes. The meat may be poisoned, in the act of smoking it, as is known to have happened to certain soldiers in Corsica, who smoked their meat with mezereon and other woods. In the careless manner of gathering rubbish for this purpose, many poisonous articles may be accumulated, and the meat may thus be effectually poisoned.

The more common source of poisoning in bacon, however, is doubtless the same fatty acid that renders sausages so deleterious, in some vicinities, and in certain seasons.

The history of a family poisoned by eating a ham-pie, made at a Parisian pastry-cook shop, is deeply interesting. The examinations, made by *Ollivier* and *Barruel*, to detect some kind of metallic poison, totally failed, and the able chemists were forced to the conclusion, that the meat had experienced a change similar to that which gives a poisonous quality to German sausages and ham.

In three hours after dining on the ham-pie, the master of the house was seized with general uneasiness, cold sweats, shivering, violent gastric pains, frequent vomiting, burning thirst, extreme tenderness of the abdomen, profuse purging and very violent colic. The poison was evidently of the *irritant* class, as the same symptoms attacked a daughter aged twenty-seven, and another aged nine. The physician who was called in supposed that verdigris, or some other salt of copper had been communicated, by the pastry-cook's copper moulds. By a vigorous course of treatment the patients recovered. The plan pursued is not stated. It should be borne in mind, however, as a reason for suspecting a copper poison, that the alvine discharges were as green as the common house leek.

Dr. Geisler has given, in *Horn's Archives* for 1828, the account of a family of eight persons,

evidently poisoned by bacon. Their symptoms, with the addition of delirium and loss of recollection, were the same with those resulting from the sausage poison. A remarkable circumstance in this history is, that the father escaped unhurt, "having stewed his bacon, while the rest ate it raw." It is supposed, that the process of stewing dissipated or decomposed the fatty acid, so as to render it harmless.

In the London Medical Gazette, vol. 19, 378, we have the case of a family poisoned by bacon, or rather, several members of the family. All who partook of the meat were sickened, and one of the children died, after severe gastric and intestinal distress, which continued for more than three weeks. Severe spasms and violent retching with dreadful headache were the attendant symptoms. *Post mortem* examination revealed extensive gastric ulceration.

The difficulty of deciding, satisfactorily, as to the true source of poisoning, in animal matters, has been alluded to. We may remark, further, that many families have been sickened and some persons fatally poisoned, by eating the meat, variously cooked, of animals that had sickened and died. The symptoms in these cases, are those of *irritant* poisoning, such as gastric pains, vomiting, severe colic, diarrhœa, &c., &c. In all these cases, it is quite probable, that the fatty matter of the animal experiences a change such as occurs in the German sausages, though this is only a conjecture. It would seem that the proper course of treatment would be to dislodge the meat from the stomach, and then to allay the irritation, by means of anodynes and rubefacients, blisters, &c., to the epigastric region.

The fatal poisoning from a wound inflicted by the dissecting knife, is too well known to require any detailed notice here. That such wounds are not always injurious is certain; and we are at liberty to suppose, that when they do prove alarming and fatal, it is in consequence of the change already named, in the fatty matter of the dead body.

In view of all the facts above stated, in reference to the poisonous agency of animal matters, may we not very rationally extend our future researches in the following queries, in the hope of reaching the truth at last?

1st. Is it not probable, that the fatal effects attending the use of the meat, milk, butter, cheese &c. of cows, as well as of the flesh of other animals, may depend on the noxious influence of *many* articles in the vegetable kingdom?

2d. Is it not probable, that *some* cases of milk-sickness, as well as the disastrous train of symptoms that follow the use of various animal matters, as articles of food, may be fairly ascribed (conformably to Orfila's suggestion) to *new principles formed or developed in the living animal, by a vital process*, and wholly independent of the pernicious agency of *any* vegetable matter?

Perhaps some of your readers may think there is no sort of relation between the several facts contained in this article. On this point I beg to differ; and hoping that some good may result from their perusal, I submit them to the intelligence and good sense of all candid inquirers.

AN ESSAY ON THE MAKING, THE PRESERVING AND THE APPLYING OF MANURES.

For the Farmers' Register.

This subject, as the caption indicates, is divided into three parts: 1st, the making; 2d, the preserving, and 3d, the applying of manures; and I shall treat the subject according to the above division. And here it is obvious to remark, that this subject is to the farmer one of primary importance; for in this section of country our lands are naturally very poor, or by long cultivation have become completely exhausted. It is therefore a question of the gravest importance, how we can most economically, and at the same time most certainly, impart that fertility to our lands, which will make them capable of producing large and profitable crops.

This subject, at this time, derives an additional importance from the fact that, owing to the exceedingly deranged state of our currency, the high rate of exchange to which we have to submit, the consequent depressed state of the market, and the extravagant and constantly increasing taxation which is imposed upon us, for the support of legislation—our salvation, and indeed our very solvency as farmers, depends upon the *large amount* of produce we can throw into the market. The time has been, as many of us well recollect, when a barrel of corn would bring $10, or a bushel of wheat $2.50, or a hogshead of tobacco would bring $250, and in some instances a still higher rate. Now, although I am no advocate for inflated prices such as these, yet it is obvious that a reaction has taken place, which has produced a state of depression still more injurious; for if the farmer can *now* get one third, or even one fourth as much for the same articles, he considers himself as having made a good sale. Our farmers are at present in this strange situation, a situation which operates with peculiar oppression upon them, that whilst their expenses with the blacksmith, with the shoemaker and grocer, and for labor, generally remain the same, and in some instances are even enhanced, nearly or quite all the products of his farm are at a slow sale, and at greatly depressed prices. The only remedy in this case is greatly to increase the amount of disposable products. Instead of *one* hogshead of tobacco, or *one* barrel of corn, or *one* bushel of wheat, we must have at least *three;* and even then our net income, compared with former times, will be greatly curtailed.

And now the question is, how are we to secure this greatly increased product? It is evident that our lands, in their present poor and exhausted state, cannot supply it. The only alternative then is to enrich the lands, if we would increase their product. And here I will remark, that bad as the times are, I have no idea of "giving up the ship," for I do know, from actual experiment, that by a judicious course of manuring and cultivation, it is practicable to increase the product of our lands some three or even four-fold. Of all mothers, Mother Earth is the most generous; the more liberal we are to her, the more liberal she will be to us.

Having made these preliminary remarks, I proceed at once to the first branch of my subject—the best method of making manures. And here I intend to confine myself to the actual circumstances of that section of country in which the

great majority of our Agricultural Society reside. In some portions of our state, large and even inexhaustible quantities of marl and lime may be commanded at comparatively little expense. Here then the very best manure is at once furnished to the industrious husbandman. But as comparatively little of these articles has as yet been found in our county, I shall say nothing as to their preparation or application. Indeed the subject, as presented, was intended to embrace, not the *calcareous*, but the *putrescent* manures.

I would observe, then, that the great basis of this article is vegetable matter. This matter, when reduced to a state of decay, is manure, but the quality may be greatly improved, and the quantity greatly increased, by a proper mixture of animal excrement. Stock then, of some kind, if not essential, is highly necessary to the making of manures. The whole subject then resolves itself into this one thing—how are we to employ our stock, so as to make them most available in this important particular? Of animals, there are three classes in common use among us—the horse or mule, the cow, and the hog. As to the first, I suppose there is but one opinion among us, and that is, that when not employed, he ought to be confined to his stable, and there plentifully supplied with litter of some kind. How long this litter ought to accumulate before it is removed, is a matter of some doubt. Some are in the habit of removing it every morning; but after paying considerable attention to the subject, I am of the opinion that it ought to remain, until by its great heat it endangers the health of the animal. It is a fact well ascertained, that decomposition goes on much more rapidly in large than in small masses. The best plan, therefore, is to keep the stable clean, not by throwing out the old mass, but by putting in frequent supplies of fresh litter. That which is already undergoing decay, will greatly expedite the decomposition of the fresh supplies. But as during this process not only great heat is evolved, but also a large amount of gases is thrown off, there is great danger of allowing this thing to proceed too far. Every farmer ought therefore to pay special attention to the condition of his stable, and when the heat becomes excessive, or when on opening the doors the slightest degree of offensive effluvia salutes him, he ought forthwith to remove the whole. My plan has heretofore been (and I am more and more pleased with it) not to throw it out in a mass, and there allow it to fire-fang, or to be torn to pieces by the hogs, but to carry it directly to the field, where it is spread, or to deposite it in small quantities, ready for future use. Fresh litter then is put into the stable to a large amount, and thus a foundation is laid for another supply.

Two methods have been successfully practised to make *cattle* useful in supplying manure. The first is to confine them to their stalls, in which case the same process is to be employed as with the horse or mule; or, 2dly, to let them have the general use of the farm pen, restricting them to their stalls only in bad weather. The latter, especially where the farm pen is kept well littered, I think the preferable mode: for on this plan, much time is saved in feeding, it being much easier to scatter the food over the farm pen, from which each one takes his portion promiscuously, than to place it in each separate stall. After taking their food they either remain in the farm pen, where their droppings are left, or if the weather be bad, they retire to their shelter and deposite them there. Here also great cleanliness ought to be observed, which can easily be secured by frequent supplies of fresh litter. Nor let any one grudge the time and care of this apparently troublesome process; for the more litter he furnishes, the more manure he will have for his exhausted fields.

There is also a third method of employing cattle in the enriching of land, of which I think very favorably, and that is by confining them to a small portion of land, until this is properly enriched, and then removing them to another portion. This is done with considerable convenience, by means of what are commonly called moveable pens. The size of the enclosure will of course depend upon the number of the cattle, and the length of time it is intended to keep them on one spot. By this expedient, especially where the number of cattle is great, a large quantity of land may be greatly improved every year. And it is done with this great convenience also, that all the labor of carting out the manure to the field, and then of spreading it, is saved. But it ought to be observed, that on this plan the land ought to be ploughed *before*, and some say *after*, it is manured. In the latter, however, I do not agree with them.

But there is another animal, the value of which has been heretofore greatly overlooked, and therefore greatly neglected, which, if properly treated, will show himself not inferior to any other in the great business of manufacturing manure, and that is the hog. In England, where this great concern is attended to with an economy and success, altogether unknown among us, each hog is taxed with ten loads of manure every year; and when he is treated properly, and is furnished with suitable materials in sufficient quantities, he invariably acquits himself as a clever fellow. But on this point I must be a little more particular. I would, then, confine my hogs in small pens, say 10 feet by 8, with a floor sloping considerably to the front. In rear of this should be another pen, say 8 by 6, well sheltered, to which the hogs might have free access in bad weather, as also for sleeping. This will afford accommodations for five or six hogs. In the front or larger pen, besides the trough for water, I would put large quantities of litter. In addition to this, I would furnish regular supplies of dirt, taken from the scrapings of roads, ditches, &c., or of rich deposites of mud collected from marshes and other low places, and, as still better than this, all the ashes I could command, and over the whole strew corn as food for the creatures. And now would commence their work in good earnest. That snout of theirs, which to my fields and ditch banks is such an annoyance, would here display itself to my immense advantage. In a very short time, they would thoroughly mix and incorporate this whole mass, so that new accessions of similar materials would be necessary. When this is the case, put in fresh supplies, and thus continue till the mass becomes inconveniently great, then remove the whole, and begin the process anew. If, upon cleaning out, the litter is sufficiently rotted, carry it directly to the field; if not, (and this is frequently the case,) let it be heaped up, in which state it undergoes a slow decomposition, and in time will be fit for removal. In this way the 5 or 6 hogs will make from 50 to 60 loads

of manure during the year. According to this, a hundred hogs (and many farmers keep that number, or even more) will make a thousand loads, and this is enough to enrich twenty acres of poor land, or to keep forty in a state of continual improvement.

I have now finished what I had to say as to the stable, the cattle shelters, and the hog-pens, as so many sources of manure. But there is another resource which, in a treatise of this kind, ought not by any means to be overlooked, and that is the farm pen. It will be conceded, that no farm can be properly conducted, without this indispensable appendage. As to the *location* of the farm pen, all will agree that it ought to be situated immediately adjoining the barns, the stables, the cattle shelters, and such other buildings as we use for storing away our winter supplies of food. Here the cattle are fed, and here we deposite the corn stalks, and wheat straw, and damaged provender, and weeds, and litter from the woods, and such other materials as we wish the cattle to tread down and to convert into manure. This is in fact the great depot of all the raw materials, which we intend to work up in the great manure workshop. But if we would conduct the concern with efficiency, we must keep a plentiful supply of materials on hand; and if with these we mix small quantities of lime, or larger quantities of wood ashes, or even of coal ashes, the quality of the manures will be greatly improved.

As yet, I have said nothing as to what is commonly called the *liquid* manures of our stock. In older countries, where the population is very dense, and where every foot of tillable land is necessary to raise the food needed by the people, and where, of course, they cannot command, from the woods and the fields, the quantities of litter which we can, there great care is taken to collect and preserve all the liquids of their stock. For this purpose their stables, both for horses and cattle, are furnished with cisterns or tanks, into which all the liquids are carefully drained; and after they have undergone the necessary putrefaction, are pumped out, and sprinkled over the crops, and great benefit is said to result from the application. But in this country, where population is lamentably thin, and woods and weeds are lamentably plenty, and large supplies of litter are always at command, I do doubt if a discreet economy would warrant the expense and trouble of collecting and applying the liquid manures. And my doubt is founded in this, that just in proportion as we increase the *liquids*, we diminish the *solids*. My theory is, that the liquids are quite as necessary, and even more so, in exciting and hastening the decomposition of the litter, than the solids are. If therefore we drain away the liquids, we arrest or at least retard the decomposition of the litter, and therefore a less quantity of manure is made. No one, I hope, will understand me as detracting from the value of liquid manures. My plan is to furnish a sufficiency of litter to absorb the whole. The liquids therefore are not only secured, but they display their great efficacy by rapidly converting the large quantities of litter into a valuable manure.

But as the term *litter* occurs very frequently in this treatise, perhaps I ought to explain precisely what I mean by it. It is, first, the corn stalks, which ought to be cut down as early as possible, and deposited upon the farm pen, and thereby passing the carts and wagons over them, and the trampling of the cattle, and the rooting of the hogs, they are broken down and made fine; so that by the next spring a considerable portion of them, perhaps half, are in a condition to remove from the top. These are carried to the corn field, and when properly managed are a great aid in the subsequent crop. The balance are left till the fall, when the most of them are sufficiently decomposed to top-dress the grass lands with. Besides this resource for litter, the fields which produced small grain, if in good heart, and none others are worth cultivating, will be found, early in the fall, well covered with a large crop of the wild carrot and other weeds, intermixed with young clover and other grasses. These ought all to be mowed down, and carefully stowed away as litter for the stable and hog pens, and I know of no material of which a richer and better manure may be made. And then they who cultivate grass on a large scale know that portions of their fields, particularly along ditch banks, and low sunken places, and corners of fences, are much infested with weeds and briers and coarse grass, such as will not make merchantable hay; these ought all to be taken care of in the same manner and for the same purpose. And then last, "though not least," leaves from the woods. When all these sources are carefully husbanded, every one must see, that an immense amount of valuable material will be stored away for the manure pile. Indeed I will venture to affirm that, as a general thing, not one farmer in twenty avails himself of the abundant supplies which he has at his command, to enlarge the stock of his manures. And as long as this continues to be the case, our land must necessarily remain poor and unproductive. For my part, I would leave the song of "*hard times*," to be sung by the merchants and other traders alone. It is a chant which very illy befits the mouth of the farmer. He, with his rich land, and habits of economy and industry at home, is an independent man. Whilst, therefore, others harp upon the ruinous exchanges, the scarcity of money, and the villany of the banks, let the farmer look well to his manure pile. Above all, let him feel that his great business is to add to the fertility of his land *every day*. Then, when others yield to the pressure of the times and become insolvent, he, with no money deposited to his credit in the banks, but with his fat hogs, his full corn crib, and his barns well stored with all kinds of provender, will remain firm amid the general wreck.

I close what I have to say on this branch of the subject, with one remark, and that is, that the quantity as well as the quality of manure will be materially affected by the quantity and quality of the food which we give to our stock. If we dole out poor food to them in limited and stinted supplies, the returns in the way of manure will be of the same character. Whereas, if we supply them with generous food and with a liberal hand, the returns will be of the same nature.

2dly. The next thing to be considered is the best mode of preserving manure. This is also a very important part of the subject; for it is surely very bad policy, to waste or destroy that which is so valuable to us, and which it has cost us so much time and labor to obtain. We should justly consider that man a maniac, who would wantonly

throw away his purse well stored with silver or gold, a case, by-the-by, which *could* occur with but very few now-a-days. Equally foolish would that man be, who would suffer his manure, the strength of his land, and the very basis of his wealth, to perish for want of proper preservation. And here I would remark, that the great enemy to be guarded against is inattention and indolence. As a general rule, manures ought always to be used, or at least placed in a situation to be used, as soon as they are thoroughly made. Manures consist of vegetable and animal matters variously combined, in a state of decay, which, in consequence of the decomposition in actual progress, are constantly evolving certain rich and nutritious gases, and these gases, if not imbibed by other living vegetables, are constantly escaping in the air. The manner in which manures benefit the growing crop, whether by entering into it in their solid state, or whether they are first decomposed into their original elements, these elements enter into it, I shall not now undertake to determine. It is sufficient for me to know that manures, as soon as fairly made, begin to waste away. Here then is a loss; nor is this loss occasioned merely by what is commonly called evaporation. It is greatly accelerated, if not principally caused, by what may be properly called a *combustion*. To satisfy any one of this, let him put a small quantity of manure in a heap, a single cart load is sufficient for the experiment, and in 48 hours or less he will see a dense vapor issuing from it, and on digging to the centre, will find that a great heat has been generated, so that a real combustion, commonly called *fire-fang*, has actually commenced. Now it is obvious, that unless this destructive process is arrested, a considerable portion of the solids will not only be burned up, but in this process we shall lose a large share of the nutritious gases also. The best preventive that I know of for this waste, is to remove the manures to the field as soon as fairly made, and then spread forthwith, or if inexpedient to spread, to place in small heaps, not exceeding 5 or 6 bushels to each. Some farmers are exceedingly afraid that their manures will sink down into the ground, and thus become inactive. I will cheerfully incur this risk, provided you give me a guaranty that they will not rise up, and be dissipated in the atmosphere. The whole secret, therefore, as to the preservation of manures, resolves itself into this one thing, to mark when they are thoroughly made, and then immediately to use them, or, at least, to place them in a situation for future use. And the longer this thing is delayed, the less manure you will have, and of course the greater loss you will sustain.

The third and last thing to be treated of is the best mode of applying manures. There are, as far as I know, but two theories on this subject; and each theory has its strong and decided advocates. The first is to use it as a top dressing; the other is to spread and immediately cover with the plough. After a long and close observation on this subject, I have come to the conclusion, that each mode, according to the circumstances of the case, is the correct one. If the manure be fine and fully made, then I hesitate not to say that the most judicious mode of application is in the way of a top dressing. If on the other hand it is coarse and but partially made, then it ought to be covered with the plough. And my reason for this course is, that the finer and well made, manures *being now in a state to act availably*, I wish to continue in that state as long as possible; whereas, I wish to change the state of the coarser, by subjecting it to as rapid a decomposition as I can effect. If, therefore, I have the coarser on the surface, it will but bleach in the sun; but if I cover it to a small depth, it will imbibe moisture, and, as it rots, impart its nutritious properties to the growing crops. On this plan, I permanently secure that which is fully made, *in its present state;* whilst, by covering, I subject the other to a continued decomposition, and thus bring it into an available state also.

The main argument by which the advocate of the covering system supports his theory is, that manures, when left on the surface, are continually subject to evaporation, and therefore lose their valuable gases and other fluids. Now what are these gases? Every chemist will tell you, and that upon actual experiment, that they are fluids, so subtle, so elastic, that it is almost impossible to confine them. This being the case, can any suppose that they can be confined by a covering of loose porous earth, such as land always is when fresh ploughed? These subtle substances —if I may be allowed the expression—would laugh at a confinement of this sort. No! the chemist can scarcely confine them in his retorts, prepared with the greatest skill. In vain then will you attempt to confine them by a slight covering of loose earth. But suffer me further to inquire, what is the *object* of confining them? Is it, that when thus covered up, they may enter into the plant by means of its roots, and thus nourish it? But it is a fact, admitted as such by every body, that the roots are not the only appendages of the plant by which it receives its nourishment. The *leaves* are essential to the plant in this respect. Hence, if you destroy the foliage of the plant, it sickens and dies; and hence caterpillars and other worms are so destructive to fruit trees. The leaf then is intended to perform certain primary functions, connected with the health and thrift of the plant. For this purpose it is furnished with two surfaces, by which, it is said, it performs certain offices very similar to respiration in the animal creation. By one, it receives the gases, and by the other, it throws them off, when they have been sufficiently elaborated. It appears, therefore, that we should but partially do our work, were it in our power, to place these fluids in a state to be taken up by the roots alone; the *leaves* require their portion, and this is indispensably necessary to the healthful thrift of the plant. My theory is simply this, that between the plant and its several parts, and these various gases, there is a strong affinity: when therefore the attraction to the root is strongest, the gases go there, and when the attraction to the leaf is strongest, the gases go there, and this is the case, whether the manures be left on the surface or covered up. In the one case, they descend to the root, in the other they rise up to the leaf, and the peculiar position in which you place them makes very little difference, for their great fluidity prepares them for the change. I have already stated that the great object is to preserve the finer manures as long as possible in their present state. Being now available, the great object is to con-

tinue them as they now are. And now the whole question is narrowed down to this single point, in which state are manures most susceptible of preservation, when left on the surface, or when partially covered? On this subject, I suppose, there can be no division of sentiment. Every one will agree, that vegetation undergoes a much more rapid decay when covered than when uncovered. In accordance with this, every farmer ploughs in his green crops, or dry crops either, when he wishes them to undergo a speedy decomposition. I conclude, therefore, that surface applications of manure are to be preferred.

COCKROACHES.

From the American Farmer, for 1827.

Having seen a plan proposed some time since, in the Farmer, for driving the cockroach from books, furniture, &c., by the use of spirits of turpentine, for the benefit of those infested with them, I propose the following plan, the success of which I have fully tested. Take an ounce vial and put in sweet oil or soap-suds, to the depth of an inch, and set the vial against the books, shelves, or places infested, so as to facilitate their getting in. They will readily go into the vial, and are unable to return, as the oil or suds renders it impossible for them to climb up the sides of the vial. I tried this plan in a closet very much infested, and in a few weeks the vial was filled within an inch of the neck. I emptied it, and in a few days there was not one to be found in the closet. If you consider this worthy of publication, it is at your service.

ON LIME AS MANURE, AND CALCAREOUS FORMATIONS OF THE MOUNTAIN REGION.

[The remarks and inquiries addressed to us by one of the most intelligent and successful improvers of land in western Virginia, concerning the calcareous tufa of the limestone streams and other calcareous substances of the mountain region, have induced the republication of the following letter, which presents views that we long ago took up on that head, and which we have since had no cause to alter, nor means to test, by further observations.—Ed. F. R.]

From the Winchester Republican.

Agricultural Society of the Valley—May 29, 1826.

A letter from Wm. B. Page, esq. enclosing a communication from E. Ruffin, esq. was received, and the communication from Mr. Ruffin ordered to be printed.

Coggin's Point, October 20, 1825.

Dear sir,—Your letter reached me only a few days before the commencement of a long journey, which has prevented my attending to your request until this time. I shall now endeavor to answer your inquiries as fully as my limited means will permit; though I cannot expect to furnish any thing of more value than loose hints, which perhaps may serve as subjects for a Frederick farmer to think about, but not as rules to direct his practice.

It should be observed, that though I have applied *mild lime* to more than 500 acres, scarcely any use has been made by me of *caustic* or *quick lime;* and therefore I have no practical knowledge of its peculiar solvent power. According to the theory of Davy, while lime continues caustic, it acts powerfully on all animal and vegetable matters in contact with it—breaking down and rotting whatever is hard, insoluble and inert—and driving off or destroying whatever is already rotten, or fit for the immediate use of growing plants. Hence, we may infer that the mere causticity of lime will be serviceable or hurtful, according to the state of the vegetable ingredients of the soil. But as usually applied, quick lime becomes as mild as before burning, by again absorbing carbonic acid from the atmosphere, before its solvent power can be exerted. Nor do I think this power can safely be used in our climate, except in very few cases; as on broom-straw old fields, or newly cleared poor woodland, which contain much inert, and but little active or soluble vegetable matter. Under our hot summers, vegetable manures rot too fast, and the cultivator should endeavor to retard, rather than hasten their decomposition. But a different practice may be proper in colder climates. Frequent applications of caustic lime must be highly useful in Scotland, for example, where vegetable matters, unrotted and insoluble, have continued to accumulate and extend, until one sixth of that country is covered with barren peat.

It follows, then, that however powerful may be the effects of caustic lime, they must be considered as separate and distinct from the durable and far more valuable effects of mild lime, or calcareous manures in general. The same substance, (quick lime) will at different periods act as two kinds of manure, entirely different in their modes of operation; and, on the other hand, many substances having different names, (as old burnt lime, chalk, shells, limestone, leached ashes, and marl,) all have different proportions of the same calcareous ingredient, and ought to be considered as the same manure. Yet most writers class these manures under different heads, without knowing the sameness of their predominating qualities; and many absurd practices owe their origin and continuance to the same error in our practical men. Thus the industrious farmers of Long Island have long used, as a manure, leached ashes, brought hundreds of miles by water: they have even sometimes stripped the soap factories in Petersburg, paying five or eight cents the bushel, besides the expense of so long a transportation. Yet, whatever benefit was obtained from this manure, they might have found as well in the fossil shells which I believe lie beneath the surface of all Long Island, and which, even if carried the same distance, might be applied at less than half the cost of an equal value of ashes. Your remarks show that we agree in this view—and that you correctly consider our calcareous manures as substantially the same, though your practice may be confined to calcined limestone, as mine has been to fossil shells.

I now proceed to answer your particular inquiries. You ask my "opinion as to the utility of lime as a manure in general; to what crops and

in what mode it is most advantageously applied; and whether there is reason to believe that it would be adapted to limestone soil like ours, originally rich, but in many places much worn by cultivation?" I never was in Frederick, and know but little of its soils, except that they generally differ from those on which my practice has been tried, and with which I am best acquainted. Your own judgment can best determine when any practice which may be profitable here, will also be advisable in your situation; and for that purpose, it will be necessary for me to state concisely my view of the means by which lime acts, and the different effects produced, referring you for the reasons on which they rest to my essay in vol. 3, American Farmer.

The principal action of both sand and clay is mechanical, and therefore large proportions are required to produce perceptible effects as manures. But from the presence or absence of a very small proportion of lime in soils, important results are produced, because in common cases lime acts chemically, and not mechanically. Clay has but little power, and sand none, in holding vegetable or animal manures: but lime combines with them strongly, fixes them in the soil, and yields them solely to the growing crop. Hence, without lime, no soil can be long otherwise than barren. Though most soils are more or less deficient, none capable of supporting vegetation can be entirely destitute of lime in *some* form. This property of lime, of combining with and fixing manures, may be advantageously used on every soil which nature has not made abundantly calcareous: but this benefit must necessarily be gradual, never quickly perceptible, nor can it be expected at all, unless on soils under meliorating culture, which will allow more to return to the earth than is taken off.

The next most important effect of lime is that of neutralizing acids. Lime is never furnished by nature pure, as it attracts acids so strongly as always to be combined with some one or other—and most generally with *carbonic*, the weakest and most abundant of all, and with it forms *mild lime*, or *calcareous earth*. This acid is driven off by strong heat, leaving the lime then pure, (or caustic,) or it will readily yield its place to any stronger acid which may be brought in contact. Thus, if a bit of chalk or limestone be thrown into diluted *aqua fortis*, the strong acid seizes on the lime, the weaker escapes in air bubbles, and (if enough lime is used) the acidity and other qualities of the aqua fortis are entirely destroyed. Such a process takes place in most of our soils when lime is applied, and probably may in some of yours. Decaying vegetables or other causes produce acids, which either combine with lime and form useful manures, or if all the lime has been already taken up, poison both crop and land. The mark of an acid soil is a vigorous growth of pine, whortleberry or sheep-sorrel. When enough lime (whether mild or caustic) is applied to a soil of this kind, the poisonous acid is destroyed, one cause of barrenness removed, and the first crop may be increased from 50 to even 200 per cent. before any other effect of lime comes into action.

There are several other minor benefits from lime, with a detail of which I shall not trouble you; for if my opinions are well founded, the two properties of fixing manures and neutralizing acids are sufficient to show that lime (and nothing else but lime) will enable us to make durable and profitable improvements on such soils as are naturally poor.

Since the publication of my early experience of marl, (as we improperly call the bed of fossil shells,) my opinion has suffered no change or abatement as to the value of that manure. I have extended the improvement over my farm as fast as possible, and generally with great benefit, though sometimes to loss. Not fearing any injury, I applied in most cases from 500 to 800 heaped bushels of shell marl per acre, about one third of which, on an average, was pure calcareous earth —and the crops of the present and preceding year have given proof that I was too lavish in the application. Several of my neighbors found equal injury from smaller dressings, but on land not secured from grazing, or more severely cropped than mine. Where equal quantities were put on, the injury on my land was in proportion to the poverty or sandiness of the soil, or the deficiency of vegetable matter: under opposite circumstances, no injury was produced even where 1000 to 1200 bushels had been laid on. The remedy for this error then is apparent—and where too much mild lime has been given, the soil is made more able to retain and profit by the vegetable matter which is then wanting. No soils have yet suffered in this way except such as were before *acid*, which induces the belief that the *salt of lime* (formed with the vegetable acid) causes this disease—and unless enough dead vegetable matter be present for this salt to act on, that it will injure the growing crop. Though I have lost some crop, and much labor, by these heavy dressings, the result has not discouraged me; it only shows the manure to be much stronger than I thought, and that less will be sufficient to produce either benefit or injury. Candor requires the statement of loss from marling, which however could not have occurred either to my neighbors or myself, if the advice I formerly gave had been attended to, viz.: to apply the manure in small quantities, and repeat it as might be found necessary; and not to use it at all, if exhausting cultivation was to be continued. No first crop after marling has suffered by this disease, (and its marks are too evident to be overlooked;) and when it has occurred in the second rotation, it never reduced the crop so low as the product of the land in its previous state. Another fact is worthy of observation: on spots where wheat of this and last year's crop was almost destroyed by overliming, clover stood and grew so well, that it promises to draw off the excess of the *salt of lime*, or otherwise to furnish enough vegetable matter to balance and cure the evil. Of this, however, my experience is as yet too limited to be considered as furnishing conclusive evidence.

When not diseased, the crops of the second rotation have been always as good, and sometimes much better, than the first crops after the fossil shells were applied. This increase was looked for, and promised, before facts had proved this effect of lime. My later experiments with first dressings give results similar to those already published. But the most satisfactory proof I can offer you of the value of calcareous manures, is a statement of my crops of wheat, which having been generally my only article for sale, and always the most important, as much as possible was raised,

and the average product may fairly be supposed to mark with tolerable accuracy the increase of fertility in the farm.

The last crop I expected would have been at least 2000 bushels, and that it fell short was entirely owing to the unexampled injury caused this season by rust. As it was, my loss was less than on any other farm in the lower country that I have heard of, as but few made half a crop, and many did not save enough for seed. This difference was mostly owing to the manure I had used, as lime hastens the ripening of all crops, and a few days difference in the ripening of a field of wheat may either cause its destruction by rust, or insure its safety.

None of my limed land brought wheat until 1820, and the following table shows that but little average increase of product had taken place before.

Years.	Acres.	Product.	Average.	
1813	145	810	$5\frac{85}{145}$	Average per acre for 3 years—$5\frac{1}{2}$
1814	110	550	5	
1815	78	520	$6\frac{52}{78}$	
1816	104	896	$8\frac{64}{104}$	Second average—8
1817	79	595	$7\frac{42}{79}$	
1818	63	450	$7\frac{9}{63}$	
1819	132	1015	$7\frac{91}{132}$	Third average—$7\frac{1}{2}$
1820	119	1020	$8\frac{68}{119}$	
1821	160	1049	$6\frac{89}{160}$	
1822	154	1627	$10\frac{94}{154}$	Fourth average—$10\frac{1}{2}$
1823	139	1475	$10\frac{85}{139}$	
1824	194	1850	$9\frac{104}{194}$	
1825	195	1452	$7\frac{37}{195}$	

Some of the after increase is certainly due to other kinds of improvement; but I have no doubt that full three-fourths of the whole was caused by the use of calcareous manures, on land rested two years in four, and not grazed. During the first six years, only about half my corn land was put in wheat, the other half being so poor that even our overseers admitted that seed would there be thrown away. You must observe, therefore, that it was the richest half of each shift that averaged from $5\frac{1}{2}$ to 8 bushels. During the last term, all the land before left out, has been in wheat, which makes the increase of average product greater than would appear from the table. Even the highest rate of product above stated, may be thought contemptible by a farmer on your fine wheat lands: but through our poor and sandy country, the average does not exceed 5 bushels for the land actually put under wheat, and it would not be 3, if all the corn land was sowed. Yet the time will arrive, when by means of our calcareous manures, this now barren region, will show the fields the most highly improved above their natural state, and more profitable farming, than any portion of Virginia.

Your doubt whether lime will suit limestone soils, arises from the supposed similar constitution of soil and manure. I have not much personal knowledge of limestone lands, but have always supposed them, as you describe yours, "originally rich," and have attributed that richness to their being manured by nature with lime. It follows, from the supposition, that the value of lime as a manure will be lessened in proportion to the natural supply; that sometimes it may be useless or even hurtful, (as when the soil will effervesce with any strong acid,) and in no case can it be as beneficial as on our pine and whortleberry lands, which are entirely destitute of calcareous earth, and nearly so of lime in any other form. But it does not follow that lime may not be advantageously applied to most limestone soils, though to what extent and profit, experience can only show; for it is a remarkable fact, that but few of those in this state contain any portion of calcareous earth, (*carbonate* of lime,) though they are evidently affected by the limestone with which they are mixed, or in contact with. To the question, what has become of the calcareous earth which the soil must have derived from the rock, I answer, that it still remains in the soil in another form: the lime being combined with the acid furnished by the decomposing vegetable matter, which being abundant enough to take up all the lime applied by nature, shows that more might be beneficially applied. I cultivate more than 100 acres of land, naturally containing a slight mixture of shells, and which, in this respect, as well as in natural fertility, I suppose is nearly similar to your limestone soils; here the effect of calcareous manures, in the first crop, is scarcely perceptible, though I confide in the benefit increasing with time, and accordingly shall marl the remainder of this soil, as soon as I can finish what is less favored by nature, and where greater improvement has been derived. But others have met with more pleasing results. Your friend, Benj. Harrison, found great benefit from fossil shells, which he carried across the river from my shore, and applied to some acres of the naturally rich land at Berkeley. The extensive improvements made with oyster shell lime, by George E. Harrison, at Brandon, are mostly on land naturally rich, and not more destitute of lime than you will find most of your limestone soils.

When I speak of limestone soils, I mean to confine the term to such as are so intermixed with limestone, or lying so near it, that the soil must necessarily have been furnished with some of its component parts from the stone. If my theoretical opinions are correct, every such soil should be naturally rich, durable, and, when worn by cultivation, easy to restore by rest or manure, compared to poor natural soils. If you know any exceptions to this rule, if any real limestone soil is poor (without being made so by such evident causes as wetness, excess of rock, &c.) I would gladly be informed of the facts, as they would furnish the only known contradiction to the opinion before stated, that a proper proportion of calcareous earth will make all soils capable of becoming and continuing rich. But if Frederick is like Augusta and the adjoining counties which I have visited, you have soils enough, which, though (by courtesy) called limestone, are not better entitled to that name than the pine lands of the lower counties. By most persons, the term *limestone* is applied, not only to any land that shows a few detached masses of that rock, but also to wherever there are limestone springs, or under which a body of limestone lies, though forty feet beneath the surface. If the soil could be made calcareous by so distant a substratum, then the whole tide-water district would be so, as a body of fossil

shells lies under the whole extent, and generally much nearer the surface. Much of this land appeared to me very poor, and I think would be as much improved by lime as any of ours.

You ask, "to what crops, or in what mode, is lime most advantageously applied?" My fossil shells produce the most immediate effect when laid on the sod before ploughing, and corn, or some other horse-hoed crop, is first raised, to mix the manure well with the soil. But when convenient, I prefer laying it on after ploughing, as it is better intermixed in the course of cultivation, and the danger of its being buried too deep is avoided. Caustic lime is usually applied to the surface of ploughed land, and slightly covered by repeated harrowings; and it is evident that this mode of covering must convert the quick to mild lime, before its solvent powers can reach the more deeply buried vegetable matter.

Until I began on cotton this year, I have made no field crops except corn and wheat, to which calcareous manures are equally beneficial. Clover is much more improved than either by lime, and without it, (applied by nature or art,) it is in vain to attempt raising clover to any extent, in this part of the state. Several years ago, I formed the opinion, that on land made calcareous, gypsum would act, though of no effect before; and though not confirmed, the opinion has gained strength from my experiments and observations, and however opposed some facts are, the greater weight of evidence is decidedly in its favor. The *acidity* of our soils, I think, will serve to account for the general want of effect from gypsum, and the supposed change of results after first applying lime; but it would be premature to offer the explanation of a fact which, however important it may be, is yet of doubtful existence. You are aware that gypsum has seldom any effect below the falls, and that most of the opposite results are on the rich river lands, of all, the most exposed to the "salt exhalations," which have idly been supposed to cause this remarkable and general defect in our lands. You state the general objection to liming in Frederick to be, first, the belief that your soils are already sufficiently calcareous, and secondly, the cost of fuel. I have before offered you reasons for my belief that your soils generally are not even slightly calcareous, and on the most accurate examination, I do not think you will find a twentieth part of even your limestone soils to contain the smallest proportion of calcareous earth. The expense of burning I cannot estimate even on the practice of neighboring farmers, of whom I have in vain made inquiries. But even if your fuel should be rather more dear than on James river, you would obtain the material for lime at far less cost. Oyster shells, taken from vessels off the landing places, cost 62½ cents per hogshead, (yielding 14 bushels of lime,) while you would quarry the rock on the farm, or perhaps the field, where the lime was to be spread. But I doubt whether burning will be necessary in every case where you may manure with lime; as its solvent power is seldom used or wanted, it will serve as well mild as caustic, if it can be broken down fine enough without heat. Limestone gravel is used to great profit in Ireland, and perhaps may be found in our limestone country; and from my own limited observation, I know that substitutes for it may be obtained in various places, if they should be found to suit as well in their quantity, as in their richness. With a view to answering your inquiries, I paid attention to the subject during my late visit to the mountains, and would have examined many supposed materials for manure, but for the want of the necessary tests; as it was, I brought home, and have analyzed, eight or ten specimens of rock, which from their softness and supposed abundance, seemed to promise calcareous manure of some value, without the cost of burning. Of these, one, frequently seen in the roads, is like limestone in color, but more like slate in softness, and easily broken into thin layers, and what is exposed to the eye might be pounded to gravel without much labor. A specimen of this, taken about midway between Waynesborough and Staunton, contained 46.100 of calcareous earth; another, taken near Lexington, on the road to the Natural Bridge, contained 80.100. The stone which covers a considerable portion of the Arsenal lot has 84.100, and though much harder than the others, is so soft as to be considered of no value for common purposes, and can be quarried and broken down with a pickaxe. A stone which is very abundant about the Salt Sulphur Springs, is so hard, in the earth, as to yield only to the force of gunpowder, yet crumbles to small gravel after a few weeks' exposure to the air. This contains only 17.100, and is too poor to pay the expense of blasting, but would be worth using, if already exposed to the air. These specimens were selected almost by chance, and even if some judgment had been exercised, it would require many more examinations to prove the strength or worth of any large bodies of such substances; and they are mentioned only to show that such manures may be found, and are worth your seeking. Another calcareous rock is found in limestone streams, which is richer than my best shell-marl, and nearly as soft: I mean that deposite of limestone water, to which the name of *marl* is as incorrectly applied in the upper country, as here to our fossil shells. This is nearly pure calcareous earth, and so far as its quantity will go it must be a very cheap as well as rich manure. In these rocks I should expect to find resources for the improvement of land; but at the same time that I offer them to your notice, I am sensible that the very descriptions given most probably show how little I am acquainted with the substances recommended.

It may be objected that calcareous manures, the particles of which being as coarse as gravel and not very soft, would not be reduced in the soil, and would consequently remain nearly worthless. Certainly the most minute division is best, and therefore 100 bushels of burnt lime, may be expected to exert as much power on the first crop, as 200 bushels in a coarser state; and it may be admitted further, that particles of limestone, or shells, would for many years defy the decomposing powers of air, moisture and frost, which are commonly supposed the only agents for producing this effect. But however hard and insoluble these small fragments may seem, I believe a soil that requires lime, will completely dissolve all of moderate size in a few years. Such at least, is the invariable effect found, when a once acid soil is ploughed up for the second rotation, after applying the fossil shells, unless they were of the largest or hardest kinds, or the dressing unnecessarily heavy. Another fact will prove that this solvent action is peculiar to such soils as I have called acid. On our

river lands, spots may be seen whitened with thin bits of muscle shells, which have been exposed at or near the surface for thousands of years, and to the action of the plough for the last century; yet muscle shells, which on those places appear so indestructible, are thinner, softer, and, from the animal matter they contain, more easy to crumble than the fossil sea shells which are used for manure. The acidity, or something equivalent to acidity, in the one soil, and the absence of it in the other, will serve to account for the very different effects produced.

Yours, &c.

E. RUFFIN.

MANAGEMENT AND BREEDS OF HOGS IN MIDDLESEX, MASSACHUSETTS.

From the Fourth Report of the Agriculture of Massachusetts.

We have been compelled, however, in this, as in many other cases, to witness the capriciousness of public favor; and to adopt, with the variation of only a letter, the familiar proverb, and say in this case, that "every hog must have his day." The popularity of the Berkshire swine is on the wane. It is objected to them by many farmers that they are not large enough, though they are easily made to reach, at fourteen months old, 300 or 350 lbs.; and further, that they do not cut up well; and that the fat on their backs and sides is not thick enough, especially for packing down for fishermen, who would be glad to have their pork all fat, and whom I have seen spread their uncooked salted fat pork, as landsmen spread butter, on their bread.

The former objection is not made by all persons, as many would prefer for their tables the pork of a hog weighing 300 lbs. to that of hogs weighing 600 lbs. of which I have seen many in our market. With respect to the latter objection, I was half disposed at first to consider it as mere caprice, but that E. Phinney, of Lexington, a farmer in this matter "not unknown to fame,"—and another most respectable farmer of Franklin county, admit that there is some truth in it; and they, as well as many others, prefer a cross to the pure blood. The impression is becoming general, and the butchers in Quincy market are unanimous in their unfavorable opinion of the Berkshire hogs. They admit that their hams and shoulders are good for bacon; but their backs, where they most require it, have no depth of fatness, and they are therefore unsuitable for salting. They are good breeders and nurses. They may be kept, therefore, to much advantage where the object is to raise roasting pigs for the market. This is sometimes quite profitable where a sow has two litters a year. A roast pig, only weaned by the knife, has from time immemorial been deemed a most luxurious dish. So it is likely to continue to be. Charles Lamb says that the Chinese never knew the lusciousness of a roasted pig until an accidental fire occurred which destroyed a pig-sty with its inhabitants. In pulling the bodies of these poor creatures burnt to a crisp from the fire, some of the skin or flesh adhered to the fingers of the Chinese, and in putting their hands by chance to their mouths, they for the first time in their lives inhaled the odor and tasted the deliciousness of the roasted skin. After that, the *accidental* burning of pig-sties became so common that the civil authorities were compelled to interpose.

It is but just, however, to the Berkshires to say, that the unfavorable impression in regard to them, though general, is not universal. An intelligent and very exact farmer at Braintree, B. V. French, has found them to answer his expectations. Upon recently killing a number, he was well satisfied with their appearance, and is of opinion that much of the prejudice which exists against them belongs properly to the impure but not to the genuine race.

The introduction of the Chinese hogs into this country and into England seems to have been the foundation of all the extraordinary improvements which have taken place in this race of animals—improvements which, within less than half a century, have doubtless enriched the state of Massachusetts many hundreds of thousands of dollars, and the country by millions. The effects of this cross with other swine have been to give fineness of bone, plumpness and fulness of form, extraordinary thriftiness, and quietness of demeanor. The old race of hogs seemed to be of the wolf species in temper as well as condition, and were the personification of ugliness and rapacity. The first introduction of one of these animals into a secluded part of Scotland, within the last century, is matter of comparatively modern history. Having got loose from his sty, he appeared to the terrified imaginations of these simple people as the arch-fiend himself, and crowds hovered together through fear—the parish schoolmaster being at their head with an open Bible, to endeavor to lay this evil spirit! The animal now, in his improved condition, is regarded as one of the farmer's best friends; he eats what nothing else will eat; he is a general scavenger, and an excellent composter of manure. His own manure is one of the most enriching substances which can be supplied to the soil, though not one of the most lasting in its effects; and his flesh is the most frequent dish upon the farmer's table. This county may boast of great improvements in their swine. A Mr. Mackay, of Boston, owning a farm in Weston, obtained from abroad, some years since, a valuable hog, whose natural good qualities by good management he greatly improved. Some of this breed of swine have been most remarkable for thrift and weight. Besides this, a hog called the Mocho hog, long, round and thrifty, whose pedigree is not known, has been introduced here. Some of the best hogs which I have seen have been from an admixture of these three bloods. Mr. Phinney emphatically approves this cross; and the weight of his swine when killed, of some of which I subjoin an account, establishes the soundness of his judgment.

In 1840, Mr. Phinney sent the following hogs to market:

	Feb. 6.		Feb. 15.		Feb. 17.	
	lbs.		lbs.		lbs.	mos. old
1	weighed 407	1	w'd 469	1	w'd 763	20
2	" 414	2	" 367	2	" 591	15
3	" 413	3	" 362	3	" 476	15
4	" 305	4	" 331	4	" 430	12
5	" 364			5	" 475	12
6	" 366			6	" 465	12
				7	" 430	12
				8	" 464	12

In 1841, the subjoined is a list of fifteen Berkshire and Mackay hogs from the same farm:

February 22, 1841.

		lbs.			lbs.			lbs.
1	weighed	738	1	weighed	528	1	weighed	487
2	"	655	2	"	523	2	"	480
3	"	579	3	"	517	3	"	476
4	"	574	4	"	503	4	"	441
5	"	556	5	"	501	5	"	400

The grass-fed hogs, which I have before mentioned, are regaining their popularity. They have been, to a degree, crossed and intermixed with various valuable breeds in the interior, and are now preferred to all others in the Brighton market. With good care and keeping, at fifteen and eighteen months old they are easily carried to 500 and 600 pounds.

Of four, fatted by Stephen Morse, of Marlborough, the current season, the weight was as follows: 539 lbs., 530, 506, 459—averaging 508½ lbs. each. These hogs were put into the sty in September, 1840, weighing between 70 and 80 lbs. each, and were killed in October, 1841. They were kept mainly upon boiled potatoes the firs winter, and since that, upon the slops of the dairy, skim milk, butter milk, whey and Indian meal.

Some of the best hogs which I have ever seen have been fatted at the slaughtering establishment of Jesse Bird, in Watertown. He keeps his swine about six months. He purchases the grass breed above mentioned, preferring hogs with a small head, round and full body, though not deep belly, and with full shoulders and broad backs. They are taken in, weighing from 170 to 200 lbs., kept in the slaughter-yard for a time, and previous to killing, are fed upon potatoes and Indian meal cooked, and are brought to weigh from 450 to 600 pounds.

At the slaughtering establishments in the vicinity of the capital, large amounts of pork are supported and fatted upon the offal. Sometimes this is cooked for the swine; in other cases it is given in its raw state, so that without any troublesome change in the way of preparation, the hogs eat the cattle and then men eat the hogs. It is easy, but not agreeable to imagine in such cases what the pork may be. The richness of animal food becomes thus a little too much concentrated even for the epicurean palate; and few persons knowingly would have the courage to touch such food when coming directly from the slaughter-yard, excepting some, who are cannibals by nature, and by some accident have been misplaced in a civilized country. It answers very well for shipping pork, for no questions of taste are ever held over a barrel of provision either on a slave plantation or at sea. It is ascertained, however, that in fatting swine, some portion of animal food and pot liquor is highly conducive to thrift. In the best establishments, the hogs, some time before being slaughtered, are put upon vegetable food, potatoes, Indian meal, &c., so that the rankness of the pork is taken away.

E. Phinney's swine establishment, at Lexington is among the most extensive in the county. His number of fattening swine averages about 100, with 50 store hogs, and they are killed in February and March, when from 10 to 18 months old, being of the fall and winter litters of the previous year. His pens are well arranged; seldom occupied by more than three or four in a pen. They have a manure-yard attached to each pen, into which bog-mud and litter are thrown for their manufacture and compounding, and they have always a dry and comfortable bed. They are fed regularly three times a day. I shall subjoin an account given by himself of his mode of management, which the farmers will read with interest.

* * * * *

"An inquiry is often made as to the best time of killing, or at wheat age it is most profitable to slaughter them. On a large farm where much green herbage is produced and where the value of the manure is taken into the account, the pigs killed at the age of 15 and 16 months, give the greatest profit. When it is intended to kill them at this age, they may be kept on more ordinary and cheaper food for the first 10 or 12 months, or till within 4 or 5 months of the time of killing. The manure they make and the extra weight of pork more than pay the expense incurred in keeping them the longer time; but the spring pigs which are to be killed the ensuing winter and spring, must be kept upon the best of food from the time they are taken from the sow until they are slaughtered.

"The older class of pigs for the first 10 or 12 months are kept principally upon brewers' grains, with a small quantity of Indian or barley meal, or rice, ruta-baga, sugar-beet, &c., and in the season of clover, peas, oats, cornstalks, weeds, &c., they are cut green and thrown into the pens; the next 4 or 5 months before killing they have as much Indian meal, barley meal or rice, with an equal quantity of potatoes, apples or pumpkins, as they will eat, the whole being well cooked and salted, and given to them about blood warm. During the season of fattening, an ear or two of hard corn is every day given to each pig. This small quantity they will digest well, and of course there is no waste. Shelled corn, soaked in water made as salt as the water of the ocean for 48 hours, with a quart of wood ashes added to each bushel and given to them occasionally in small quantities, greatly promotes their health and growth. Their health and appetite is also greatly promoted by throwing a handful of charcoal once or twice a week into each of their pens. Their principal food should, however, be cooked thoroughly and nicely. From long practice and repeated experiments, I am convinced that two dollars' worth of material well cooked, will make as much pork as three dollars' worth of the same material given in a raw state.

"Pigs when first taken from the sow should be treated with great care, to prevent them from scouring and becoming stinted; when either of these happen, it will require many days and sometimes weeks to put them again into a healthy growing condition. When first deprived of the maternal food, a little new or skim milk, boiled and slightly salted and given to them often and in small quantities, will prevent scouring and greatly promote their growth. If intended for killing at the age of 9 or 10 months, they should be full fed all the time and kept as fat as possible. If, on the other hand, they are intended for killing at the age of 15 or 18 months, they should not be full-fed, nor be made very fat for the first 10 or 12 months.

"To satisfy myself of the benefit of this course, I took 6 of my best pigs 8 weeks old, all of the same litter, and shut them in two pens three in each. Three of these I fed very high and kept them as fat all the time as they could be made. The other three were fed sparingly, upon coarse

food, but kept in a healthy, growing condition, till within 4 or 5 months of the time of killing, when they were fed as high as the others. They were all slaughtered at the same time, being then 16 months old. At the age of 9 months the full-fed pigs were much the heaviest, but at the time of killing, the pigs fed sparingly, for the first 10 or 12 months, weighed, upon an average, fifty pounds each more than the others. Besides this additional weight of pork, the three "lean kine" added much more than the others to my manure heap. These results would seem very obvious to any one who has noticed the habits of the animal. In consequence of short feeding, they were much more active and industrious in the manufacture of compost, and this activity at the same time caused the muscles to enlarge and the frame to spread, while the very fat pigs became inactive, and like indolent bipeds, they neither worked for their own benefit nor for that of others.

"For the purpose of increasing my manure heap, my pens are kept constantly supplied with peat or swamp mud, about three hundred loads of which are annually thrown into my sties. This, with the manure from my horse stable, which is daily thrown in, and the weeds and coarse herbage which are gathered from the farm, give me about 500 cart loads of manure in a year.

"On regular and systematic feeding and clean and dry bedding, the success of raising and fattening swine very much depends. A faithful feeder, also, who has some skill and taste and withal a little pride of vocation, is indispensable."

Of all articles ever given to fatting swine Indian meal is, without doubt, the most nutritious. Mr. Phinney, it seems, has by actual trial settled a much vexed question, whether hogs should be forced by full feeding when young, or at first be only kept well in a growing state. He found it better, when designed to be kept more than a year, to let the young animal, by sufficient but not excessive feeding, have time to develope himself and acquire a natural size, rather than, by filling him to repletion, to bring on a premature state of fatness, which seemed to check the growth. To young pigs, milk, whey and buttermilk are the best of all feed; but where cows are kept for the purpose of supplying the market with milk, the pigs will be of course regarded as very poor customers. "The milkman will not call." There is however, as I have shown before, under some circumstances, a mistake in this matter.

The establishment of J. P. Cushing, Watertown, for keeping and fatting swine, is upon a large scale, and is exceedingly well contrived for his situation. It consists of a long one-story building, with separate pens on one side extending the whole length, each designed for four swine, with an open yard and a lodging and eating room to each besides some lying-in apartments.* A commodious passage-way runs the whole length of it, with the troughs projecting into the passage-way, and a shutter for the troughs so contrived that the trough is easily cleaned at any time, and the food of the hogs is placed before them without admitting that which, in the usual slovenly mode of feeding, is but too common, an uncivil interference on their part before all is ready. Some contrivance as effectual as this for another class of animals would be quite useful at some of our public hotels and steamboats, and save us from the severe remarks of those foreign travellers who have little sympathy with our customary despatch of business, and seem to look upon us as a nation of fire-eaters.

The cooking apparatus is at one end. Had economy of room and ease of feeding been studied, the building might have been double the width, with pens on each side. In England, they are sometimes made circular with the cooking apparatus in the centre and the feeding troughs all within the circle; but in such cases there must be much waste of room. Mr. Cushing's barracks are lengthwise of his cattle-yard, so that the manure from the pens of his swine is thrown immediately into the yard, and any litter or muck easily supplied in the same way. His store hogs, too, at pleasure may be turned into the cattle-yard with the advice given in Æsop's fable by the dying father to his sons, "that there is a treasure buried in the field which they would find by digging for it." The swine however do not much need the advice. They are natural philosophers and go by instinct into deep investigations. Some of them should always be kept in barn-yards and cellars. They are of great use in turning up and mixing the manure; and in yards where cattle are fed upon grain, and the sweepings of the barn floors are thrown out, they take care that nothing is lost. I have known a considerable number of store hogs kept in a thrifty condition upon that only which they obtained in a yard where a proportional number of beef cattle were stall-fed. The philosophy of reciprocal uses, which is apparent in every department of nature, though it frequently presents itself in a form offensive to a fastidious taste, is to a reflecting mind always instructive on the wonderful economy of the divine providence.

A very large hog establishment in this county is to be found in West Cambridge on the farm of Abner Pierce. He keeps in his enclosure about 500 hogs. They are supported upon the city swill or refuse. No hogs are allowed to be kept in Boston but by special and extraordinary permission; and among the excellent municipal regulations, the refuse vegetables, meat, garbage, and offal of the houses are required to be kept by each householder in a box or barrel which is emptied once a week or oftener by the city scavengers. This, being taken into the covered city carts, is delivered at Mr. Pierce's establishment, about five miles from the city, daily—he paying therefor to the city 4000 dollars per year on a contract for five years.

His hogs, when I visited him, were in an enclosure of about fourteen acres, partly covered with trees and bordering on one of the beautiful ponds in that vicinity, a picturesque situation most certainly, for animals making such humble pretensions to taste and sentiment. If nothing else, however, in the summer months they enjoy, as much as their betters, the luxury of a refreshing bath and quiet repose under the shade, both essentially conducive to their health and thrift.

* The length of this building, including the cooking-place, is 252 feet, width 12 feet, and height the same. There are twenty pens, each 12 feet by 8, and a yard of 12 feet attached to each pen. The number of hogs that can be accommodated depends upon their sizes—from three to six, say an average of four of 300 weight each. There were fatted fifty-two hogs last season, weighing, dressed, 15,573 lbs.

He has had no general disease among them, though occasionally a case of the "blind staggers." He considers this troublesome disease as proceeding wholly from indigestion; and he finds no difficulty in its cure, by procuring an immediate evacuation. For this purpose he gives a dose consisting of half a pint of lamp oil, and half a pint of molasses, strongly charged with pounded brimstone. This remedy is important to be known, as the disease is not uncommon among swine, and often proves fatal. This disease can hardly be considered local, though the "blind staggers" in years gone by, has been known to prevail in some localities near at least one of these ponds among a class of animals, who assume to be of a higher rank, but who occasionally pollute these beautiful regions by a resort to them for purposes of dissipation; but a simple and perfect preventive is at last found for *this* disease, (so much more humiliating and dreadful in its effects on *them*,) if they can be induced to take it, in "total abstinence."

Mr. Pierce's hogs are purchased; he raises none. He buys them at a weight of 100 to 150 lbs. Their average weight when killed, is from 250 to 300 lbs. He has a killing twice a year, though many of his hogs are kept a year. The supply of refuse from the city, is sufficient, excepting at certain seasons of the year, when some meal and corn are given. They fatten in the yard without extra feed, excepting as above. At killing, the skins (that is the small entrails) are sold at 10 cents a set; the harslet at 8 cents; which pay fully the expenses of dressing. The remainder is cooked for the swine, after saving and selling what can be used by the soapmaker. The manure made in their beds where they are littered, is sold readily at four dollars per cord and in quick demand. The average sales of manure are not less than one thousand dollars.

In the enclosure there are extensive plank platforms on which the garbage is spread when brought from the city. The right of cleaning the tables, after the hogs have filled themselves, is purchased by several neighboring farmers at $2 50 per day. Much of the refuse thus obtained is spread upon their grass lands, or ploughed in on their cultivated grounds, or placed round their apple trees, and in every case with the greatest advantage. If not used immediately it is put into a compost heap and covered with mould. Some farmers who obtain it use much of it for feeding their own swine. One farmer stated to me that he had purchased the right of obtaining it two days in a week. He kept the last year fourteen hogs entirely upon these gleanings. The gain upon these hogs in live weight from 1st October to 1st April, when he sold them on foot, was 2800 lbs. Other farmers have been equally successful in this economical process.

The average gain of the hogs at this establishment is rated at a pound per day, live weight. A large amount of bones are brought out in the carts, and these find a ready sale at the bone-mill for manure.

The question of profit in keeping and fattening swine has been much discussed, and so much depends on circumstances of age, breed, food, length of time kept, and price in the market, that the question must remain open. Mr. Phinney gives it as his opinion that with Indian corn at one dollar per bushel and potatoes at 33 cents, and the price of pork 12 cents, they may be fatted to a profit. In his experience, he says, four quarts of Indian or barley meal with an equal quantity of apples, pumpkins, potatoes or roots cooked, will give two pounds of pork.

A small example of fatting swine in Medway, Norfolk county, which came under my notice, seems worth recording, because an exact account of their cost was kept. The owner was a mechanic and bought every article of their feed, not even keeping a cow. His two hogs when killed weighed, one 420 lbs.—one 382 lbs., and pork was then worth 12 cents per lb. Value when dressed $96 24 cts. They were killed at 14 months old. They were bought in November and killed in the December of the next year. They were kept in the sty the whole time; were fed three times a day with weeds, corn and potatoes. The potatoes were boiled and the Indian meal mixed with them into a mash. They were fed exclusively on corn one week before being killed. They did as well in winter as in summer. Salt was frequently given to them in their swill. The price of corn bought for them was 117 cents to 136 cents, or an average of 130 cents per bushel. Potatoes were 30 cts. per bushel. The whole cost of the hogs when fatted was $62 including the price of purchase, or 7.8 cts. per lb.

I shall here subjoin some careful experiments made by myself a few years since in relation to this subject. They were given to some portion of the public at the time, in another form; but they may here reach many by whom they have not been seen, and to whom they may be interesting.

Experiment 1. Two hogs about one year old; one of them a barrow in very good condition; the other a barrow recently gelded and in ordinary condition, were put up to be fed exclusively upon Indian hasty pudding or Indian meal boiled with water. We began feeding them the first of March, 1831, and weighed them again on the nineteenth of the same month. In the eighteen days they consumed six bushels of Indian meal. They were offered cold water to drink but did not incline to take any. The result—

No. 1 weighed on 1st March, -	233 lbs.
" " 19th " - -	269
gain	36
No. 2 (recently gelded) weighed on 1st March	190
" " 16th "	247
gain	57

The gain of the two was 93 lbs. in 18 days. The quantity of meal consumed by them was 10 quarts per day to the two. We allow 30 quarts to a bushel deducting two for grinding. The price of corn at the time was 70 cents per bushel. The expense of the increased weight is 4.5 cents per lb.

March 21, 1831. Killed the hog mentioned first in the foregoing experiment. Live weight 273 lbs. Weight when dressed 215 lbs. Loss in offal, loose fat included, 58 lbs. or a little more than one fifth.

Experiment 2. No. 2 mentioned above weighed

on 23d March, -	253 lbs.
do. on 30th April, -	312
In 38 days, gain,	59 lbs.

No. 3, a shoat purchased from a drove weighed
on 28th March, - 100 lbs.
do. on 30th April, - 151

Gain in 33 days, - - - 51 lbs.

This is a fraction over 1 lb. 8 oz. per day each, nearly 1 lb. 9 oz.

In this case their food was exclusively boiled potatoes mashed with Indian meal. The exact amount consumed not ascertained, but fed as freely as they would bear.

Experiment 3. The two last-named hogs were for the next 20 days put upon Indian hasty pudding exclusively, with the following result:

No. 2 weighed on 30th April, - 312 lbs.
" " 20th May, - 382

Gain in 20 days, - - 70 lbs.
No. 3 weighed on 30th April, - 151
" " 20th May, - 185

Gain in 20 days, - - 34 lbs.

The two in the above named 20 days, consumed 4½ bushels of meal, cooked as above. Meal 78 cents per bushel. Gain of the two, 104 lbs. in 20 days.

Experiment 4. Sundry swine purchased from a drove, and fed with meal and potatoes, washed and mashed—

	28th March, 1831. lbs.	19th May, 1831. lbs.		lbs.
No. 1 weighed	97,	165,	gain in 52 days	68
2 "	134,	182,	" "	48
3 "	100,	186,	" "	86

The two following, raised on the farm, and fed as above—

	25th April, 1831. lbs.	19th May, 1831. lbs.		lbs.
No. 4 weighed	151	206,	gain in 24 days,	55
5 "	140	165,	" " "	25

Experiment 5. In this case it was not intended to force their thrift, but to keep the swine in an improving condition. They were shoats of the last autumn, and were of a good breed.

Tuesday, 3d April, 1833. Put up four shoats, and began feeding them with Indian hasty pudding.

	3d April.	22d April.		25th June.	
No. 1	176 lbs.	202 lbs.	gain 25	264 lbs.	gain 62
2	119	153	" 34	226	" 73
3	150	170	" 20	218	" 48
				[Total 183 lbs.	
4	121	145	" 24	Killed May 30.	

From 3d April, to 22d April, the above swine consumed seven bushels and one peck of Indian meal. From 22d April, to 25th June, seven bushels of Indian meal, cooked as above.

One of the above, No. 4, was killed on 30th May; being absent, the live weight was not ascertained.

On the 25th June, the three remaining hogs were weighed, and in the 63 days from 22d April to 25th June, they had gained in that time 183 lbs. as above.

After 30th May, when one of them was killed, one peck of meal made into hasty pudding with a small allowance of the waste of the kitchen for a part of that time, lasted them three days, that is 22-25 or less than a quart, say ⅞ of a quart per day to each.

At first we employed half a bushel of Indian meal to make a kettle of hasty pudding; but we soon found that a peck of meal by being boiled sufficiently would make the same kettle nearly full of hasty pudding and of sufficient consistency. The kettle was a common-sized five-pail kettle, set in brick work in the house; and it was remarkable that the peck of meal produced nearly the same quantity of pudding, that we obtained from the half bushel, which showed the importance of inducing the meal to take up all the water it could be made to absorb.

The price of Indian corn was at that time 75 cents per bushel—30 quarts of meal to a bushel deducting the toll. The amount of meal consumed in the whole time from 3d April to 25th June was 14¼ bushels—the cost $10 69—the total gain, making no allowance for the gain of No. 4, from 22d April to 30th May, which was not ascertained, was 287 lbs.

The gain of No. 1, 2 and 3, from 22d April to 25th June was 183 lbs. in 63 days; and allowing one peck to serve the three hogs for three days, required 5¼ bushels, the cost of which was $3 94. The live weight could not be estimated at less than 4 cents per lb. when pork was at market 6 cents.

The value of the 183 lbs. therefore was equal to $7 32, or at 5 cents to $9 15 cents.

The gain of the swine for the first 19 days, from 3d to 22d April, was:

No. 1, 26 lbs. or 1.368 per day.
" 2, 34 " or 1.789 "
" 3, 20 " or 1.052 "
" 4, 24 " or 1.263 "

The gain from 22d April to 25th June, 63 days, was:

No. 1, 62 lbs. or 0.984 per day.
" 2, 73 " or 1.158 "
" 3, 48 " or 0.761 "

The difference of daily gain in the two periods was attributable to the diminished quantity of meal. The question then arises, whether the first mode of feeding was as economical as the second.

In the first 19 days, 7 lbs. 1 peck consumed, gave 104 lbs. gain. In the next 63 days, 5 lbs. 1 peck consumed, gave 183 lbs. gain.

Had the first gain been in proportion to the second gain in reference to the meal consumed, the 7¼ bushels which gave 104 lbs. should have given 252 5-7 lbs. This great disparity can be explained only in the more economical preparation of the meal, by which a peck, taking up as much water as it would contain, gave a kettle nearly full of pudding, when half a bushel of meal imperfectly prepared, gave little more. This seems to demonstrate the great advantage of cooked food, both as it respects its increase of bulk and the improvement of its nutritive properties. Whether it would apply to those substances, whose bulk is not increased by cooking equally as to Indian meal and the like, is a matter which experiments only can determine.

Such are some few trials in reference to the feeding and fattening of swine, which I have made, or information of which I have obtained from other sources, which may at least lead the inquisitive farmer to further experiments and inquiries, on a subject of great importance to his interest. The inferences to be made from them I shall leave to others. The results, as will be observed, are not uniform. The thrift of animals must depend on various other circumstances

besides the kinds or the quantity of food given them. Much depends on the breed, as every farmer knows; much on the health of the animal; something on the season of the year. I failed in attempting to fatten several swine in one case, though they were carefully attended and various kinds of feed were tried, and the failure was totally inexplicable until they were slaughtered, when the intestines were found corroded with worms, resembling those found in the human stomach, and this, I have no doubt prevented their thrift. The same fact has occurred in another instance, and with the same result. I failed in attempting to fatten some other swine, who had been driven a considerable distance and exposed, probably not even half fed on the road, to severe cold and storms. Some of them were frost-bitten in their limbs; and though attended and fed in the most careful manner they made no progress for months. In an experiment recently made, of giving swine raw meal mixed with water, I have found a falling off in their gain of nearly one half, compared with giving their food cooked, such as boiled potatoes and carrots, mixed with meal while hot; the result being in a sty containing a number of swine, as 279 to 500. In respect to confinement or freedom, various opinions are entertained. The Shakers at Canterbury, N. H., deem it indispensable to the thriving of their swine that they should have access to water to wallow or to wash themselves in; and that they by no means do so well without it. On this point I have had no trial further than to satisfy myself that fatting hogs are sometimes injured by being suffered to root in the earth.

With respect to the age at which it is advantageous to put up swine to fatten, I have only to remark, that it is with swine as with other animals, there are some breeds which come much sooner to maturity than others. A successful farmer in Saratoga county, N. Y., says that March pigs, killed about Christmas, are the most profitable for pork. Four pigs of what is called the grass breed, were slaughtered at Greenfield, N. Y., which weighed 348 lbs., 318 lbs., 310 lbs. and 306 lbs. at nine months and seventeen days old.

On this point, I present a letter with which I was honored by the late John Lowell, whose authority in the agricultural community is justly estimated.

"*Dear sir:*—I have been prevented answering your inquiries as to my experience in raising old or young pigs. I may say that I have fully and clearly ascertained, from a trial of 20 years, that young pigs of from 25 to 30 lbs. will give nearly double, in some remarkable case three times as many lbs. as shoats of 6 months weighing from 100 to 150. I have taken two pigs of 100 lbs. each, age six months, and never was able between May and November, to get them above 180, rarely above 170. I have taken three pigs of about 30 lbs. each, and on the same food which I gave to the two, they would weigh from 170 to 180 each in the same period;—nay I have taken pigs of 200, and never could get them to weigh more than 300 in 7 months on my food. The way I ascertain the quantity of food is, that I never give any thing but the produce of my dairy, and the refuse of the garden, peaches, apples, and cabbage, which are uniform generally.

"3 pigs of 90 wt. or 30 wt. each, will give ordinarily 510 lbs.
less original wt. 90 often not more than 60.
gain 420 lbs.

2 pigs of 100 wt. each, will give ordinarily 340 lbs.
less original wt. 200
gain 140

"But the 3 pigs of 90 will not consume for the first 3 months half so much as the 2 of 100 each, and I have kept a 4th and sold it in August for quarter pork.

"There is nothing new or remarkable in these facts. It is the law of the whole animal creation. It is true of the calf and of man. The child of 7 lbs. quadruples its weight in 12 months; and the calf of 60 wt. if fine and well fed will weigh 600 wt. at the end of the year, and (if a female) will not double the last weight at any age.

"P. S. It should be remarked that the weight at purchase is live weight, and at sale dead or net weight, because in truth, to the owner this is the true mode of considering the subject. No doubt my sort of food is peculiarly favorable to young animals, it consisting in very liberal allowance of milk. If the older pigs were at once put on Indian meal they would attain to 250 lbs. at a year old, but the cost of the meal at 70 cts. per bushel would amount to 9 dollars, and if the first cost, 5 dollars 50 cents, be added, and the pig sold at 6 cents, there would be but 2 dollars gain on 2 pigs of 100 lbs. each; while 3 small pigs without meal fed on milk would give 24 dollars in the same time. I do not mean to give minute details but general views. As an important qualification of the foregoing statement it should be added, that shoats of 6 months bought out of droves have usually been stinted in their growth, and animals like trees, recover slowly after a check. I presume if shoats were taken from a careful and liberal owner the difference would be less. But as a general law it may be safely affirmed, that weight for weight at the purchase, the younger the animal the greater the positive, and the far greater the net gain. At least such is my own experience and belief."

The preceding facts and experiments encourage the belief that hogs may be raised and fattened by the farmer to advantage, where corn is worth about 70 cents per bushel, and his pork will bring him 6 cents per lb. Success must greatly depend on skill, care, selection, and good management. The best swine that I have ever found have been in dairy countries, for there cannot be a doubt that milk and whey for every animal are among the most nutritious of aliments. Indian meal probably ranks next, though many farmers prefer a mixture of provender, such as corn, oats, rye, or barley; but I believe in all cases cooked food will have a decided advantage over that which is given in a raw state: an advantage more than equivalent to the labor and expense of its preparation. Potatoes are a valuable article of food, but the pork is not so good as that fattened upon corn. Carrots are more nutritious than potatoes. Corn given in a raw state or on the ear is a most wasteful management.

Swine ought to be kept on every farm in sufficient numbers to consume all the offal and waste of

the dairy and kitchen. If, beyond this, a breed can be obtained, which will arrive at early maturity, and which can be advantageously grass-fed or kept at a small expense and in an improving condition through the summer; and being put up to fatten early in autumn and forced as much as possible so as to be sent to market early in the winter, the farmer will ordinarily find a fair profit in this branch of husbandry. A great advantage is found in the keeping of swine from the valuable returns of manure, both in quantity and quality, which are obtained from them, where care is taken to supply them with raw materials for the manufacture. Too much care cannot be bestowed in the selection of the breed and the general health of the animal when put up to feed; and it is strongly recommended to every careful farmer occasionally to weigh the animal and measure the feed, that he may ascertain seasonably on which side the balance of debt or credit is likely to fall. Nothing is more prejudicial to good husbandry than mere guesses and random conjectures; and though the result of our operations may not meet either our wishes or expectations, an intelligent mind will be always anxious as far as practicable to know precisely how far they correspond with or disappoint them.

The profit of fatting pork with us has become much more questionable since such vast amounts of salted pork and hams are brought into our markets from Ohio and the far western states, through the great and constantly increasing facilities of transportation. It is judged that much more than a year's supply is now on hand in the city of New York, and the new has not begun to come in.

This must essentially affect our markets. But it is to be considered that to a certain extent our own pork here will always be preferred; and that fresh pork, the lean pieces, will always be wanted in our market, with which the western pork can not at present come into competition, though after the experience of the last five years, it might be almost rashness to say that our markets may not yet be supplied with roasting pigs and fresh spareribs from Cincinnati. Then again there is on every farm a certain amount of refuse and offal, which may be profitably given to hogs, and would otherwise be lost. There is another circumstance, which must go to the credit of our swine. Manure in Middlesex county is every where valued at least at 4 dollars per cord on the farm. A hog duly supplied with the raw material, for a hog cannot, more than an Israelite, make bricks without straw, will make three cords of valuable manure in a year. A sow well kept likewise may raise a litter of pigs, and may be fitted for the market in the same year. These circumstances may encourage us to think that, in spite of western competition, a certain amount of pork may be profitably fatted among us every year. It is comparatively a recent discovery that apples are as good for fatting swine as potatoes. This opinion has been expressed to me by many farmers in this county. Apples may be cultivated to an indefinite extent and at a small expense. We may easily avail ourselves of this advantage. The opinion of many of these farmers is, that they are better given raw than cooked. This point will, I hope, be made matter of experiment. The fatting of hogs, however, is subject to so many contingences, that under present circumstances, excepting where extraordinary supplies of food are easily obtained, upon a large scale, it can be safely undertaken only with extreme caution and care. Many, who have undertaken it, have been unsuccessful.

ERRATUM.—Vol. IX. p. 679, 4th line from foot of 2d column, for "enormously," read "numerously."

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THE FARMERS' REGISTER.

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EDMUND RUFFIN, EDITOR AND PROPRIETOR.

ON THE PRESERVATION OF MANURE.

From the London Farmers' Magazine.

Sir,—You will be aware that the objects of manure are to restore to the soil those substances necessary to the growth of plants, which are removed in the *crops*. Though this perhaps is not the only point to be considered when treating on *manures*, it is evidently one of the utmost importance. The mechanical influence of the soils is no doubt great, but its consideration peculiarly belongs to the cultivator. In the present letter, I shall endeavor to draw your attention to those manures which are calculated to increase the nutritious properties of the cereal grains, and those grasses which are the indirect means of giving food to man.

The substances removed by crops from the soil must be restored; some plants remove one class of salts, some another; but all those which are fitted to the support of animal life take from the soil the *nitrogen* contained in it. For all plants cultivated for the use of man contain *nitrogen*, and in proportion to the quantity of this element so are the nutritious qualities of the food. The nutritious parts of wheat and all grain are in fact exactly of the same composition as flesh and blood. The following is a statement of the numbers:

	In gluten, the nutritious part of wheat.	*In blood.*
Carbon, - - -	54.603	54.56
Hydrogen, - - -	7.302	6.90
Nitrogen, - - -	15.59	15,72
Oxygen, sulphur, phosphorus,	22.286	22.82*

This shows that nitrogen is a very important constituent in the food of man.

To ill preservation in manure I shall now take the liberty of calling your attention.

Nitrogen is supplied to plants in a wild state from the atmosphere†—in a cultivated state from the soil and atmosphere. In manuring lands then we return to them the nitrogen which has been taken from them in the crops, and we always return it to them in the form of some compound of ammonia. The goodness of manure, or its fitness to restore the nitrogen to the soil, consists in the quantity of ammonia, which is composed of nitrogen and hydrogen, including those substances containing nitrogen which sooner or later will be converted into ammonia or hartshorn by the putrefactive process.

Let us now consider the state of a heap of manure, consisting of animal excrements, liquid and solid, which contain large quantities of nitrogen in the form of ammonia; let us consider, I say, this heap of manure lying exposed to the influence of the weather during a hot summer. The nitrogenized parts are gradually converted into ammonia, and the greater part of this ammonia is volatilized and carried into the atmosphere. We cannot have failed to remark the smell of this body when passing by a heap of manure in a hot day, even though we be at a considerable distance from the spot where the manure is deposited; to taint so large a quantity of air with its smell, would require a large quantity of ammonia; and what passes into the atmosphere is comparatively lost to the agriculturist, or it does him no more good than his neighbors, for it is carried down by the rain and spread equally over the country.

Ammonia or hartshorn possesses the properties in common with all alkalies of uniting with acids, and forming with them in most cases compounds of sparing volatility. All aluminous minerals and those containing *peroxide* of iron possess also the power of condensing the volatile alkali in such a manner that it is not carried away and lost by every gust of wind that passes over the dunghill. Alumina and peroxide of iron are in fact very nearly allied, and possess the property of combining with ammonia in common, one being isomeric with the other. Ammonia, *the active part* of manures, may be rendered fixed, it has been said, by *acids*, and you will allow me to point out the practicability of this plan in the first instance. In *urine* that has undergone putrefaction, ammonia exists as carbonate, phosphate, lactate, &c.; the first of these salts is continually evaporating, and ammonia is set free from all the other salts by adding lime, which is a practice too common. Let us now suppose a manure consisting of these salts mixed with organic matter, to be watered with a weak solution of sulphuric acid (oil of vitriol); the salts of ammonia are decomposed and a sulphate formed—this sulphate is quite fixed. The composition of this sulphate of ammonia is *per cent.* ammonia 39.48, sulphuric acid 60.52. For every 60 pounds of sulphuric acid employed (and it costs but a penny a pound), 39.48 pounds of ammonia are fixed in the manure, and may be kept for any period of time without loss.

We shall see the advantage of this method of proceeding by following the annexed calculation:—100 pounds of hay contain one pound of nitrogen, and every hundred parts of ammonia contain 82.54 *per cent.* of the same element. For every hundred pounds, then, of ammonia, conveyed to the soil in this manner, there will be produced, supposing all the nitrogen to be assimilated in the proportion to form hay, 82,000 pounds of hay.

Calculating the advantages at a much less rate than the above, the profit in nitrogenized parts that will be produced will amply repay the agriculturist for the trifling outlay in sulphuric acid. Indeed, no opportunity of preserving the ammonia produced by animals should be neglected; a few pounds of sulphuric acid being mixed in a diluted state with the manure would be of immense advantage. Throwing down sulphuric acid in all places where excrementitious matter collects, would be a never failing source of nitrogen, containing manure laid up in a safe form ready for use. The absurd practice of using lime for removing those smells caused by ammonia cannot be too much deprecated, as lime immediately set

* Annalen der Chemie und Pharmacie, xxxix. 149.
† Liebig, Agr. Chem.

free all the ammonia which the manure contains, and it is lost.

The manure preserved by sulphuric acid should be thrown in the soil with gypsum, and would be a never failing source of nitrogen. The same good results will arise, though in a less degree, from the use of burnt clay and other aluminous minerals; but from their property of forming insoluble compounds with ammonia, and uniting with no other bases, they are more adapted to the immediate application to the soil, than for being mixed with manure. Another advantage which sulphuric acid possesses is, that it converts all the lime that may happen to be in the soil into gypsum, which is a sulphate of lime.

T. G. T. Ph. D.

ON THE COMPARATIVE FEEDING PROPERTIES OF MANGEL-WURZEL AND SWEDISH TURNIPS.

By the Right Hon. Earl Spencer.

From the Journal of the Royal Agricultural Society of England.

My dear sir,—You expressed a wish that I should again publish the results of an experiment which I made fifteen or sixteen years ago on the comparative feeding properties of Swedish turnips and mangel-wurzel. It was published in the 'Farmer's Journal' of that day, but I believe it is now very little if at all remembered; and I agree with you in thinking that it may be more interesting now, when men's minds are more turned to this sort of investigations.

The mode of ascertaining the nutritious properties of different kinds of vegetable food by chemical analysis, which was adopted by Sinclair and other scientific men, gives a reasonable probability of their relative value; but we know so little of the processes of nature in converting food into the flesh of the animal that consumes it, that this mode has never appeared to me quite satisfactory. Although, therefore, I believed that mangel-wurzel contained more saccharine matter than Swedish turnips, and ought consequently to be the more nourishing root of the two, I determined to try practically whether an ox fed upon mangel-wurzel increased in weight more than one fed upon Swedish turnips, in proportion to the quantity of each consumed. In order to have rendered my experiment perfectly accurate, I ought to have ascertained the weight of hay consumed by each beast during the progress of the trial, but I did not do this, although I am pretty confident that the quantity consumed by each was nearly the same. I selected two steers, tolerably and at least equally well-bred: No. 1, calved March 29, 1823, and No. 2, calved May 6 of the same year; and on the 24th of December, 1825, I put No. 1 to Swedish turnips, and No. 2 to mangel-wurzel. I ascertained their weight by measurement, and both of them measured the same, viz. 4 ft. 10 in. in length by 6 ft. 5 in. in girth, making them to weigh 668 lbs. each. On the 23d of January, No. 1 had consumed 1624 lbs. of Swedish turnips, and measured 4 ft. 10 in. in length by 6 ft. 7 in. in girth, making him to weigh 703 lbs., and to have increased in weight 35 lbs., or at the rate of 48¼ lbs. for every ton of Swedish turnips consumed. No. 2 had consumed 1848 lbs. of mangel-wurzel, and measured 4 ft. 10 in. in length by 6 ft. 8 in. in girth, making him to weigh 721 lbs., and to have increased in weight 53 lbs., or at the rate of 65½ lbs. for every ton of mangel-wurzel consumed.

This difference, however, might have arisen from No. 2 having a greater propensity to feed than No. 1; I therefore now put No. 1 to mangel-wurzel, and No. 2 to Swedish turnips. On the 20th of February, No. 1 had consumed 1884 lbs. of mangel-wurzel, and measured 4 ft. 11 in. in length by 6 ft. 8 in. in girth, making him to weigh 734 lbs., and to have increased in weight this month 31 lbs., or at the rate of 36¾ lbs. for every ton of mangel-wurzel consumed. No. 2 had consumed 1880 lbs. of Swedish turnips, and measured 4 ft. 11 in. in length by 6 ft. 8 in. in girth, making him to weigh also 734 lbs., and to have increased in weight during this month 13 lbs., or at the rate of 15½ lbs. for every ton of Swedish turnips consumed. I then put both to mangel-wurzel, and divided the food equally between them. On the 19th of March, they had each consumed 1792 lbs. of mangel-wurzel; No. 1 measured 5 ft. in length by 6 ft. 10 in. in girth, making him to weigh 784 lbs., and to have increased in weight 50 lbs.; No. 2 measured 5 ft. in length by 6 ft. 9 in. in girth, making him to weigh 765 lbs., and to have increased in weight 31 lbs.

It would appear, therefore, as if the propensity to feed of No. 1 was greater than that of No. 2 in the proportion of 50 to 31; but notwithstanding this, in the first month, when No. 1 was upon Swedish turnips, and No. 2 upon mangel-wurzel, No. 2 beat No. 1 in the proportion above stated of 65½ to 48¼. It appears as if there could be no great inaccuracy in estimating the relative weight of the animals, as soon after the experiment was concluded I sold No. 1 to a butcher in the country for 24*l.* 3s., and No. 2 at Smithfield for 24*l.*

It will be for practical men to decide upon the value of this trial; what appears to me to be the most conclusive part of it is, that No. 2, who had during the first month, when he was feeding upon mangel-wurzel, increased in girth 3 in., in the next month, when his food was changed to Swedish turnips, did not increase in girth at all, and when in the third month he was feeding again upon mangel-wurzel he again began to increase in girth, because it is very well known that, if an animal is changed from more to less nutritious food, the probable consequence will be that his growth will be stopped. The results appeared to me so decisive, that I have not tried the experiment with the same accuracy since; but I did try the following year the feeding a cow alternately on Swedish turnips and mangel-wurzel, and though I have not by me the details of the trial, I remember that the result confirmed the experiment of the previous year. Believe me, my dear sir, yours most truly, SPENCER.

Philip Pusey, Esq. M. P.

WORM IN THE KIDNEY OF SWINE.

From the Democratic (Me.) Clarion.

Mr. Editor:—I am induced to send you the following statement, not so much from the importance

of this particular case, as from its being a link in the great chain of testimony in favor of a more humane and improved treatment of diseased swine.

In Oct. last, I observed that a thrifty young shoat of mine was weak in the back: he grew worse for several days, until he could scarcely move about, or even get up. At this stage of disease, I commenced feeding him with corn, boiled soft in strong lie, with the addition of a handful of charcoal. This feed was continued four or five days, at which time the hog had to all appearances become as well as ever, and so continues to this time. J. D. Hill.

No. 3d Range, near Bingham.

OF THE PRESERVATION OF RACES BY SEED.

From Lindley's Horticulture.

The manner of preserving the domesticated races of plants by the ordinary means of propagation, such as cuttings, layers, grafts, and so on, has already been explained; there are, however, some other topics connected with this important subject which require to be touched upon.

Propagation by division is inapplicable to annuals or biennials, or at least can be practised upon only a very limited scale, and for such plants the gardener has to trust to seeds alone. But it is an axiom in vegetable physiology that seeds reproduce the species only, while buds (that is, propagation by division) will multiply the variety; and this is undoubtedly true as a general rule. But the skill and care of the gardener often enable him to perpetuate by seed the many races of cultivated annuals, varieties of the same species, improved and altered by centuries of domestication, with as much certainty as if he were operating with cuttings. In a well managed farm we see the various breeds of turnips and corn preserving each its own peculiar character unchanged year after year, and yet they must all be propagated by seed alone; and in gardens the varieties are innumerable of peas, lettuces, cabbages, radishes, &c., whose purity is maintained by the same means. The manner in which this is effected is of the first importance to be understood.

Although it is the general nature of a seed to perpetuate the species only to which it belongs, and it cannot therefore be relied upon, in ordinary cases, to renew a particular variety of the species, yet there is always a visible tendency in it to produce a seedling more like its parent than any other form of the species. Suppose, for example, the seed of a Ribston pippin apple were sown; if untainted by intermixture with other varieties, it would produce an apple tree whose fruit would be large, sweet, and agreeable to eat, and not small, sour, and uneatable, like the wilding apple or crab. The object of the gardener is to fix this tendency, and he does it by means not unlike those employed in the preservation of the races of domesticated animals, namely, by "breeding in and in," as the phrase is. An example of this will be more instructive than a dissertation. The radish has, when wild, a long pallid root; among many seedlings one was remarked with roots shorter and rounder, and more succulent than the remainder; this was a "sport" to which all plants are subject. Had that radish been left among its companions, and the seed saved from them all indifferently, the tendency would have disappeared for that time; but its companions were all eradicated, and the better one produced its seed in solitude. The crop of young plants obtained from this radish was, for the most part, composed of individuals of the wild form, but several preserved the same qualities as the parent, and some, perhaps one only, in a higher degree: in this one, then, the tendency was beginning to fix. Again were all eradicated, except the last-mentioned individual, whose seeds were carefully preserved for the succeeding crop; and, by a constant repetition of this practice for many years, at last the habit to produce a round and succulent root became so fixed, that all the radishes assumed the same appearance and quality, and there were none left to draft or "rogue." Every variety of annual crop, not still in its wild state, must have gone through this process of fixing; and thus the varieties of earliness, lateness, and productiveness, color, form, and flavor, observable in garden plants, have been secured for our enjoyment.

But to fix a new habit in annual plants is not the only care of the cultivator, whose patience and skill would be ill employed if it could not be preserved. If a plant has some tendency to vary from its original condition, it has much more to revert to its wild state; and there can be no doubt that, if the arts of cultivation were abandoned for only a very few years, all the annual varieties of our gardens would disappear, and be replaced by a few original wild forms.

For the means of preserving the races of plants pure, the means vary according to the nature of the variety. As far as concerns early and late varieties, it often happens that, as in peas, the tendency in such plants to advance or retard their season of ripening was originally connected with the soil or climate in which they grew. A plant which for years is cultivated in a warm dry soil, where it ripens in forty days, will acquire habits of great excitability; and, when sown in another soil, will, for a season or so, retain its habit of rapid maturity: and the reverse will happen to an annual from a cold wet soil. But, as the latter will gradually become excitable and precocious, if sown for a succession of seasons in a dry warm soil, so will the former lose those habits and become late and less excitable. Hence, the best seedsmen always take care that their early varieties of annuals are procured from warmer and drier lands than those on which they are to be sown; our earliest peas, for example, are obtained from France, and the next in time of ripening from the hot dry fields of Kent, the Suffolk coast, and similar situations. Thus, also, the barley grown on sandy soils, in the warmest parts of England, is always found by the Scotch farmer, when introduced into his country, to ripen on his cold hills earlier than his crops of the same kind do, when he uses the seeds of plants which have passed through several successive generations in his colder climate; and Mr. Knight found that the crops of wheat on some very high and cold ground, which he cultivated, ripened much earlier when he obtained his seed-corn from a very warm district and gravelly soil, which lies a few miles distant, than when he employed the seed of his vi-

cinity. It would seem as if this were in some way connected with the mere size of a seed, the smallest seeds of a given variety producing plants capable of fructifying quicker than those of a much larger size. We have, at present, but little information upon this subject; but there are some most curious experiments relative to it by Messrs. Edwards and Colin, who found that, although winter wheat cannot, in France, be made to shoot into ear, if sown in the spring, provided the largest grains of the variety are employed, yet that, if the smallest grains are picked out, some will ear like spring wheat (see *Annales des Sciences Naturales*, v. 1.) Out of 530 grains of winter wheat, sown on the 23d of April, and weighing 7 ounces 52 grains, not one pushed into ear, they tillered abundantly, but the tillers were excessively stunted, and concealed among the tufts of leaves; in short, they formed nothing but turf: on the other hand, of 530 other grains, weighing 3 ounces 56 grains, and sown on the same day, 60 pushed in ear.

It would seem as if many of our most esteemed garden plants were the result of debility, and that the succulence, the sweetness, or the excessive size, which render them so well suited for food, were only marks of unhealthiness. At least, it is almost necessary to assume this to be the case, in order to account for the efficacy of one of the modes of maintaining races genuine. It is perfectly well known, that, if such an annual as a turnip is transplanted shortly before it runs to seed, the characters of its variety will remain more strongly marked, and have far less tendency to vary, than if, all other circumstances remaining the same, the seed is saved without the process of transplantation having been observed. Now, the only effect of transplanting, at the season immediately preceding the formation of a flower-stalk, would seem to be that of checking the luxuriance of the individual operated on; or, upon the above assumption, of increasing its debility of constitution. And the same explanation appears applicable to a strange custom mentioned by Mr. Ingledew as being practised in the Dekkan, to prevent the rapid deterioration, in that climate, of the carrot, the radish, and the parsnip, the favorite table vegetables of the inhabitants. He states that the Indian gardeners, in the first place, prepare a compost of buffaloes' dung, swine's dung, and red maiden earth, mixed with water till they have the consistence of paste, and scented with a small quantity of assafœtida, the latter of which seems to be perfectly useless.

"The vegetables for this operation are drawn, when wanted, from the beds, when they have attained about one third of their natural growth, and those plants are chosen which are the most succulent and luxuriant; the tops are removed, leaving a few inches from their origin in the crown upwards; and a little of the inferior extremity, or taproot, is cut straight off likewise, allowing nearly the whole of the edible part to remain, from the bottom of which to within about an inch of the crown, are made two incisions across each other entirely through the body of the vegetable, dividing it into quarters nearly to the upper end. They are then dipped into the compost until they are well covered by it, both externally and internally, and are immediately placed in beds, previously prepared for their reception, at the distance of fifteen or sixteen inches from each other, and so deep in the ground that the upper extremities only appear in sight. They are afterwards regularly watered; and when they take root, and fresh tops have made some advance in growth, they require but little attention. The tops speedily become large, and grow into strong and luxuriant stalks, the blossoms acquire a size larger than ordinary, and the seed they produce is likewise large and vigorous, and superabundant in quantity. Innumerable roots are thrown out from the incised edges of these plants; they consequently receive a greater abundance of nourishment, which occasions their luxuriant growth, causes them to yield not only a more than ordinary crop of seed, but also of a superior quality." (*Hort. Trans.*, v. 517.) The operation is performed at the beginning of the dry season.

Besides "roguing out" (i. e. eradicating) all individuals having the slightest appearance of degeneracy from among the plants intended for seed, care must be taken that the crop is so far from any other of a similar kind as to incur no risk of being spoiled by the intermixture of its pollen. This substance is conveyed to considerable distances by wind and insects; and it is scarcely possible to be secure from its influence, if similar crops are cultivated within some miles of each other; whence we find certain villages, in different parts of Europe, celebrated for the purity of the seed of particular varieties; this usually happens in consequence of the villagers cultivating that variety and no other, as happens at Castelnaudary with beet, at Altringham with the carrot, and in Norfolk with different kinds of turnip.

It is, however, to be observed, that the deterioration of seed by bastardizing happens to a greater extent to single plants than to large masses of them; and it seldom happens that good seed can be saved in a garden, or near gardens, from a single individual. Solitary specimens of the turnip, the cauliflower, and such plants, have been frequently selected on account of their perfect characters, and been carefully planted in gardens for a stock of seed, but their produce has as frequently been of the worst description, bearing no resemblance to the parent. In such cases as these, it would seem as if bees and other insects were attracted from all quarters by the gay colors, or odor, of such isolated individuals, and, arriving from a hundred flowers which they had previously visited, bring with them so many sources of contamination.

When, however, the action of other flowers can be prevented, as in the melon and other unisexual plants, by "setting," the largest, healthiest, and most cultivated varieties will yield seed of the purest and finest quality. The tendency of Persian melons to degenerate in this country was remarked soon after their introduction; and, for a long time, it was thought impossible to preserve them for many generations. Mr. Knight, in his numberless experiments upon this fruit, found that to be the case; for his fruit, at one time, became less in bulk and weight, and deteriorated in taste and flavor. But when he came to consider that "every large and excellent variety of melon must necessarily have been the production of high culture and abundant food, and that a continuance of the same measures which raised it to its highly improved state must be necessary to prevent its

receding, in successive generations, from that excellence," the cause of his Persian melons deteriorating became apparent; and he found that by bringing the cultivation of the plants to a state of great perfection, he succeeded completely in rendering the original quality hereditary, as long as those precautions were observed. No man was more successful in the cultivation of the melon than Mr. Knight; and it is in the memory of many persons, that the quality of his sweet melons of Ispahan has very rarely been equalled. The peculiar methods that he adopted appear to have been the complete and most careful preservation of the leaves from injury of whatever kind, the full exposure of their surface to light, and the augmentation of the ordinary warmth of a melon bed by availing himself of the heat reflected from brick tiles with which his bed was paved. To such an extent was his care of the leaves carried, that he would not allow even the watering to be performed "over-head," but he caused his gardener to pour water, from a vessel of proper construction, upon the brick tiles between the leaves, without touching them. (See various papers upon the melon in the *Horticultural Transactions*, and especially that in vol. vii. p. 584.)

While, however, such are the general principles upon which the preservation of the peculiar qualities of the many races of cultivated annuals necessarily depends, it must be confessed that, according to report, there are circumstances upon which science can throw no light, and which, if true, must depend upon conditions as yet unsuspected to exist. Of this class is the following, respecting the Brussels sprouts cabbage, given upon the authority of M. Van Mons.

"Much has been said of the disposition of this plant to degenerate. In the soil of Brussels it remains true, and I have lately observed it to do the same at Louvain; but at Malines, which is the same distance from Brussels as Louvain, and where the greatest attention is paid to the growth of vegetables, it deviates from its proper character, after the first sowing: yet it does not seem that any particular soil or aspect is essential to the plant, for it grows equally well and true at Brussels, in the gardens of the town, where the soil is sandy and mixed with a black moist loam, as in the fields, where a compact white clay predominates. The progress of deterioration at Malines was most rapid; the plants raised from seed of the true sort, which I had sent there, produced the sprouts in little bunches or rosettes, in their true form; seeds of those being saved, they gave plants in which the sprouts did not form into little cabbages, but were expanded; nor did they shoot again at the axils of the stem. The plants raised from the seed of these last mentioned only produced lateral shoots with weak pendent leaves, and tops similar to the shoots, so that in three generations the entire character of the original was lost. From a plant in the state last described, seed was saved at my request, and sent back to me. I had it sown by itself, and carefully watched the plants in their growth; I was not long in discovering that they retained the same character of degeneration they had assumed at Malines, and preserved it throughout the whole course of their growth, yielding pendulous leaves with long petioles, and having no disposition to cabbage. I suffered these plants to run to seed at a great distance from my true sprouts, which the extent of my garden allowed me easily to do. The second sowing brought them back a good deal to their true character; the plants yielded small cabbages regularly at each axil, but not generally full or compact, and they did not shoot a second time, as the true sort does. I again suffered these to run to seed, using the same precaution of keeping them by themselves. I sowed the seed, and this time the plants were found to have entirely recovered their original habits, their head, and rich produce." (*Hort. Trans.*, iii. 197.) I must confess, however, that, although the passage merits quotation, for the sake of exciting attention to the subject, it appears to me very doubtful whether the case has been fully, if correctly, stated.

UPON THE MAKING OF CIDER.

From the London Farmers' Magazine.

The production of good cider must depend upon the description of fruit of which it is made, the season and state of the apples when they are crushed, and the management of the juice whilst it is fermenting. It will therefore be proper to consider the subject under these three heads separately:—

The kind of apple which makes the best cider.—The acid which gives the peculiar quick and sharp feeling upon the palate in good cider, having been first noticed in the apple, although it exists in many other fruits, has been termed the malic acid. It may not be too much to say, that it is the due combination of this acid with saccharine matter, namely, the sugar of the apple, properly fermented, which are the objects to be aimed at in the manufacture of cider. In the selection of the fruit, will depend the proportion of malic acid contained in the liquor. The crab has a much greater quantity of this acid than the cultivated fruit; and generally speaking, in proportion as we obtain sweetness by culture, we deprive the apple of its malic acid. Hence, it follows that some delicious table fruits will not make good cider: this rule, however, is not invariable, as the golden pippin and some other fine apples appear to contain the proper admixture of acid and sweetness which is desirable in the liquor. Mr. Knight recommends that the different sorts of fruit be kept separate, and considers that only those apples which are yellow or mixed with red make good cider, and that the fruit of which the flesh or rind is green are very inferior; he recommends that the apples should be perfectly ripe, even mellow, but never decayed, before they are crushed. There was a curious manuscript written by Dr. John Beale, a fellow of the Royal Society in 1657, upon the subject, from which the following are extracts:—"Crabs and wild pears, such as grow in the wildest and most barren cliffs, and on hills, make the richest, strongest, the most pleasant, and lasting wines that England yet yields, or is ever likely to yield. I have so well proved it already by so many hundred experiments in Herefordshire, that wise men tell me that these parts of England are some hundred thousand pounds sterling the better for the knowledge of it." He mentions of these kinds of austere fruit the Bromsbury crab, the Barland pear, and intimates "that though the discovery of them was then but lately made, yet

they had gotten a great reputation." He adds, "the soft crab and white or red horse-pear excel them and all others known or spoken of in other countries. Of the red horse-pear of Felton or Longland, he says, "that it has a pleasant masculine rigor, especially in dry grounds, and has a peculiar property to overcome all blasts." Of the quality of the fruit he observes, "such is the effect which the austerity has on the mouth on tasting the liquor, that the rustics declare it is as if the roof were filed away; and that neither man nor beast care to touch one of these pears, though ever so ripe." Of the pear called Immy winter pear, which grows about Ross, in that county, he observes, "that it is of no use but for cider; that if a thief steal it, he would incur a speedy vengeance, it being a furious purger; but being joined with well-chosen crabs, and reserved to a due maturity, becomes richer than good French wine; but if drunk before the time, it stupefies the roof of the mouth, assaults the brain, and purges more violently than a Galenist." Of the quality of the liquor he says, "according as it is managed, it proves strong Rhenish, barrack, yea, pleasant Canary, sugared of itself, or as rough as the fiercest Greek wine, opening, or binding, holding one, two, three, or more years, so that no mortal can yet say at what age it is past the best. This we can say, that we have kept it until it burn as quickly as sack, draws the flame like Naphtha, and fires the stomach like aqua vitæ." Thus there appears a great difference between the opinions of the two men who probably paid more attention to the subject than any other; and the question naturally arises, is the cider and perry of the county as good or better than it used to be, after greater attention having been paid to the orchards? I am decidedly of opinion that it is inferior; and it was this impression which caused me to venture to call your attention to the subject. If such be the case, it is a great object to ascertain what has caused the deterioration in the liquor. I believe that it is for want of a due proportion of the peculiar acid which is found in the greatest quantity in the wild fruit; and beg to suggest whether it would not be worth while to try back, and mix a certain quantity of crabs with the fruit before it is crushed. We have many of us tasted, and all heard of, the Stire and Hagloe crab cider, both of which were so celebrated for their rich quality; and these fruits differed little from wild apples. It is known that the juice of crabs, if kept long enough, will make excellent vinegar; every housewife knows that, however sour the liquor may be at first, it will not answer for pickling, but that if kept a sufficient time, there is no better for the purpose. It cannot be supposed that one acid is changed into another without passing through an intermediate stage, and this must be the malic acid, having been converted into sugar, which it appears in the ripening of fruit it has a natural tendency to do. The object in making cider of such fruit, is to prevent the sugar when formed passing on to the acetous fermentation. A singular circumstance occurred at Baysham: a hogshead was filled with crab juice, intending to keep it till it became vinegar; but the cask was tapped by mistake, and supposed to be cider until it was all drunk, which in fact it was. Crab juice ferments much more slowly than the juice of the apple, propably owing to there not being enough sugar already formed in the liquor: but I am of opinion that if some of the heading from a cask of cider in a state of fermentation were added to the crab juice, it would ferment as readily, and clear itself as soon, as the juice of the apple. Owing to the slowness of its fermentation, it takes a great deal of time to convert the juice of crabs into vinegar; but it is found that if, after crushing them, the must be put into a cask for some days, till it heats considerably, and that if the liquor afterwards be ground with this must and pressed again, it will pass into vinegar immediately. I therefore strongly recommend a mixture of the most austere and hardest apples which can be procured with the soft and mellow fruit before it is crushed.

The best time of the year for making cider.—It has been before observed that Mr. Knight recommends the fruit to be perfectly ripe, even mellow, before it is crushed; and this can only happen late in the autumn. As it is known to be more difficult to manage the fermentation of the liquor in warm weather, it is usual to defer making cider till November and December; if, however, the liquor can be put into a cold cellar after the first fermentation is over, I am of opinion that it might be commenced earlier. The juice of unripe fruit ferments more quickly than of that which is ripe, and contains more malic acid. Where there is the convenience of a good underground cellar, the difference of temperature between that and the outward air is greater in moderately warm weather than in November; so that if the liquor were fermented under sheds, as Mr. Knight recommends (and his instructions as to the management of the cider whilst fermenting are excellent,) and as soon as fine, removed into the cold cellar, the change of temperature would be greater at the end of September than in November; and this would probably tend greatly to prevent the liquor fermenting again. If the new cider cannot be removed from the warmth of the atmosphere, there can be no question that it is better to defer the making till the weather becomes cool.

Fermentation of the juice.—The researches of scientific men, although very elaborate, have done very little in throwing light upon the nature of fermentation; it appears to partake in a measure of the vital principle; of the phenomena attending which, we know nothing. Many curious and interesting facts have been discovered during the investigation, but none of which appear likely to be of much use in the making of cider. There are three kinds of fermentation, or rather, there are some products which pass regularly through three stages of fermentation, viz., the vinous, the acetous, and the putrescent. Other substances pass at once to one or other of the latter stages; gum and water turning to vinegar without forming any spirit, and meat at once putrefying. It is not desirable that the vinous fermentation should be complete in the manufacture of cider, in which case all the sugar of the apple would be converted into spirit; this never does happen without a portion of vinegar being also formed, the acetous fermentation going on jointly with the vinous, as, when cider frets a great deal it may be very strong, but is comparatively of little value, having lost all its richness and become sour. The vinous fermentation stops naturally before it has run its course, and it is the object of the maker to avail himself of this property in the liquor, and to endeavor to prevent any secondary fermentation

taking place ; the number of schemes which have been suggested to prevent which, showing that it is the most important point to be attended to in the manufacture of good cider. I am of opinion that the 100 gallon cask is much better than larger, and that the liquor is not only more easily managed, but more likely to be good ; it may be that cider in large casks becomes stronger, but not so frequently rich, as in single hogsheads. Although it may not be apparent, fermentation commences as soon as the juice is expressed from the fruit ; and the sooner the cask is filled and allowed to remain quiet, the more regular and certain will be the process. What should we think of a brewer who, whilst his beer was working, brewed another quantity, and added the raw wort to the first ? Yet this is constantly done in filling a large cask with cider ; or even worse, for the apple juice is added cold, whereas the wort might be mixed with the beer whilst warm. It would be greatly better to keep the liquor in open tubs till enough be obtained to fill the cask, and then put it together at once. If I may be allowed to suggest an experiment, there is one use to which I should be very glad to see a large cask applied ; that is, to fill it partly with *fresh* must, and the remainder with boiling water ; the probable result would be a very pleasant and useful liquor. Temperature has much to do with fermentation, and it would be of advantage to have two cellars, one much colder than the other. If the liquor, upon pitching fine, were racked into a clean cask, and put into a cold cellar, there would be much less risk of its fermenting again. I should recommend no other liquor to be added to it ; but in order to prevent ullage, that it should be racked into a smaller cask ; the less air admitted the better, and if the cask be sound and iron bound, it may be better to close it altogether at this time. The application of cold will check fermentation immediately. I have seen liquor in a state of froth, boiling out of a large jar, suddenly reduced to a state of quiescence by pumping upon the side of the jar. This fact induced me to cause an experiment to be tried at Gayton during a very bad season for cider making, the weather being very warm : a cask of juice was rolled from the mill into a brook of cold water, and sunk by stones attached to it ; it remained in that position till nearly Christmas, and was so much better than any other made there that year, that Mr. Newman obtained double the price for that hogshead he did for any of the rest. Perfect stillness is very desirable, as motion is found to excite the acetous fermentation. A bottle of wine, attached to the sail of a windmill in motion was, after three days, converted into vinegar, although closely corked. When a second fermentation does take place in cider, there is very little hope of its being rich and good. In such case I should recommend its being drawn out into tubs, exposed to the cold as much as possible, and after being thus flattened put back into the cask, at the same time well stirring up the whites of fifteen or twenty eggs previously mixed up with a portion of the liquor ; if this succeed in fining it, which probably it will, it may then be racked into a clean cask, and closed as much as possible from the air. It is probable that a great deal of mischief is caused by some principle of fermentation remaining in the cask ; this might be prevented by well scalding before the casks are filled ; or what I think would be better, by washing out the casks with clear lime water ;—one large piece of lime put into a hogshead of water, and allowed to settle, would answer the purpose. Some brimstone matches burned in the cask would have a great tendency to prevent fermentation. I shall not say much upon the mode of crushing the apples and pressing out the juice, having had so little practical experience, but I have always thought that if the fruit were crushed between wooden rollers, and allowed to drain before being put under the stone, that the process would be much expedited, as the apples sometimes roll before the stone a long time before they are broken. In Ireland they use a press formed by a lever, which might be made at less expense than with a screw, and be more quickly worked : it is impossible the pressure can be too light at first, and it should be increased gradually as the liquor runs from the must. Two sets of bags, allowing one to drain for some time without pressure, would be an undoubted advantage.

EDWARD PRICHARD.

Ross.

MAKING DIPPED CANDLES.

From the Journal of Commerce.

The season of the year has arrived for families in the country to make up their supply of candles for the year, and as much trouble and extra labor is occasioned by want of skill, I will, in order to enable people to obviate this, give some brief directions for dipping candles.

The tallow, when melted, should be ladled into a wooden vessel of convenient width and depth, which has been previously heated by filling it with boiling water for an hour or more. Fill the vessel within an inch of the top with melted tallow, and keep it that height by adding hot tallow or hot water. By this means the candles will be kept of a full size at the top, and not taper off to a point, as is often seen with country candles.

The tallow, when used for dipping candles, should not be too hot. A temperature that will allow the finger to be dipped in without burning, is sufficiently hot, and at this temperature the candles will take on the tallow very fast. The wicks should be lowered into the melted tallow gradually, and should be lifted out of the tallow so slowly that when the bottom of the candles are clear from the surface of the melted tallow, no tallow will run off them. When the candles are raised quick out of the melted tallow, the tallow will run off the candles in a stream, whereas if the candles are raised out slowly, not a particle of tallow will fall from the candles. A few trials will satisfy any person in this matter. If the tallow is boiling hot, the wick will not take on the tallow to any considerable extent. When candles are raised out of the tallow rapidly, the candles will be large at the bottom, and the tallow will extend below the wick, so that when burnt in the candlestick a piece of the candle will have no wick in it ; and therefore, for burning, will be useless. Where persons have no suitable wooden vessel, an iron vessel will answer for a dipping vessel. When tallow has been thoroughly melted over the fire, should it be dirty or impure, throw into it, while hot, a small quantity of finely

powdered alum, and in a short time a scum will be seen rising to the surface, in appearance like dirty froth. Skim this off as it rises. This scum will rise for half an hour or more. These directions are plain and easily complied with, and one trial will be satisfactory. Persons, by following these directions, will save more than one half the usual labor of making candles, besides having better candles. I speak from abundant experience, and therefore with full confidence. E. M.

KENTUCKY BLUE GRASS (GREENSWARD, POA PRATENSIS.)

From the Nashville (Tennessee) Agriculturist.

The best time for sowing is as soon as you get ready after October, but if you sow before the middle of March, you may expect a good stand, particularly if the season is wet.

Land.—Old fields, where the sun can exert all his powers, produce blue grass in the greatest abundance, and always of the best quality. The past fall we visited Mark R. Cockrill's farm, and saw old fields on which former occupants were threatened with starvation, yielded the richest grass. It was remarkable that his mares and sucking colts, on these pastures, without grain, were fatter, if possible, than we ever saw "the noble animal" on other treatment. But inasmuch as cultivated grounds are generally used for other purposes, the beginner is informed that woodland, particularly where the timber is not too loose, will produce good grass.

Preparation.—If you intend old land for pasture, break up the fields, and sow them in oats in February. Then put ten lbs. of blue grass seed, a half a gallon of red clover seed, and if a little timothy or orchard grass be sprinkled on so much the better. The clover, timothy and orchard grass will give a quick pasture and afford protection to the blue grass till it gets a strong hold, after which no other grass can contend with it. If woodland is to be sown, take off the logs, brush, leaves, &c., and if the undergrowth could be taken out, it would be much better. After the land is cleaned, harrow it well, then sow your grass seed at the rate of ten or twelve pounds to the acre, but if you put on fifteen or twenty pounds, you will scarcely ever regret it. The rains will sufficiently cover the seed to insure vegetation.

ON GUANO.*

By James F. W. Johnston, F. R. S., &c., Hon. Mem. of the Royal English Agricultural Society.

From the Journal of the Royal Agricultural Society of England.

Of the natural occurrence of Guano.—Guano, according to Humboldt, is the European pronunciation of the word "huanu," which in the language of the Incas means dung or manure. The substance long known by this name occurs at various points along the coast of Peru, between the 13th and 21st degrees of south latitude, both on the main land and on the numerous islands and rocks which are sprinkled along this part of the shores of South America. It forms irregular and limited deposites, which at times attain a depth of 50 or 60 feet (Humboldt,) and are excavated like mines of iron ochre. It is not known to exist in any quantity north of 13° or south of 21°; though the flocks of cormorants, flamingoes, cranes and other sea-fowl (from the droppings of which it has been derived,) appear to be equally numerous along both the more southerly coast of Atacama and the more northerly shores of Arequipa.

Mr. Winterfeldt, who appears to have more recently visited the west coast of South America, has published the following additional information in Bell's Weekly Messenger of the 11th of September, 1841:—

"There are three varieties of guano—the red, the dark-gray, and the white. The first two are met with in the isles of Chincha near Pisco, at

* Perhaps some readers may deem the subject of this article, however curious as a matter of history and of natural science, of no practical value, and therefore not worth the space it will here occupy. But the subject is not only one of interest as a very remarkable, and until now unexplained, fact in natural history, but the circumstances, as now explained, throw important lights on agricultural science. That the excrement of sea-birds, a substance among the most putrescent, and consequently elsewhere of fleeting existence, should have remained in mass for ages, and in the torrid zone, was of itself sufficiently remarkable. And the fact had been of enough importance to be recorded in history, because of the immense value of the manure, and the great use made of it, by water transportation, by the ignorant aboriginal inhabitants of Peru, and by their Spanish conquerers and their indolent descendants. Added to these facts, the deposites of excrements were so enormously thick and extensive, as almost to amount to the importance of a geological formation.

It now appears that the absence of moisture (from rain) prevents putrefaction, in a great degree; and this most remarkable, because vast effect, of a well-known law of fermentation, will serve to show to farmers, in all regions, that without moisture their manure loses nothing by the sun and air. The great richness of *guano*, and its value as manure, after all the actual waste of its most volatile parts for centuries, shows strongly the great value of *ammonia*, no matter from which of the many sources it may be obtained; and the importance of preventing its waste from all manures which evolve it during putrefaction. And in addition to these general theoretical truths, of various and extensive application in practical agriculture, it *may be* that the products of this immense mine of manure in the Pacific ocean, may hereafter be brought to benefit American, as it has already done British agriculture. This may be still the more strongly counted on, now that it is ascertained that the most recent guano is far more rich than the ancient, which is what has been mostly exported heretofore.—Ed. F. R.

Iquique, and on the hill of Pica. The term 'guano of Iquique' is sometimes used from its having been first procured from the island of that name. This island is situated about 400 yards from the port of Iquique. It is about half a mile long, and about 200 yards broad; and furnished large quantities of guano for 25 years, when it became exhausted. The hill of Pica is very high, and is covered with guano down to the water's edge; while that side which does not face the sea is of sand and gravel. In this hill or rock I am informed that a silver-mine was formerly worked, but that no trace of guano was found during the excavation. The adjoining hills on either side are of sand, which is carried by the winds, and covers up the guano; to remove which the sand is first taken away, and deep excavations are made; the guano extending nearly a quarter of a league in length, and 300 *yards in depth.** It is likewise found at St. Lobos, about three leagues to the south of Pica; but, as the anchorage is dangerous, little business is done here."

Origin of the guano.—The extraordinary thickness and extent of these deposites of guano seem at first sight to throw discredit on the statement that it is altogether derived from the dung of the countless flocks of sea-fowl which frequent the islands and rocks of the Peruvian shore: yet the evidence on this point is perfectly satisfactory. The living birds still deposite the white guano on the islands to which they resort. In the isles of Islay and Jesus 20 to 25 tons of this recent guano are occasionally collected in a single season. In the island of Torrecilla the white may be seen changing into the red variety (Winterfeldt;) while, in the midst of the great accumulations of the latter kind, bones and feathers (Frezier) of birds are found, as if to remove any doubt which might still remain as to its origin. Its real origin, indeed, was well known to the government of the Incas, and its national importance fully understood. It was made a capital offence to kill the young birds on the guano islands. Each island had its overseer; and as the whole coast from *Arica* to *Chaucay*, a distance of 200 leagues, was manured almost entirely with guano, each island was assigned to a special district of the main land, and its produce was conveyed to that district alone. (Humboldt.)

It was not till the arrival of the Spaniards that the original source of the guano was for a time doubted; yet, when we consider how great a lapse of time it must have required to admit of the accumulation of the extensive beds of ancient guano still known to exist, we cannot wonder that early European visiters should have received with hesitation what we now readily admit as the true account of its origin. Of late years the increase of traffic on the coasts has disturbed or driven away the birds, and thus materially diminished in many localities the annual produce of the white or recent guano. "Since the opening of the port of Islay the birds have nearly deserted the adjacent inlets." (Winterfeldt.)

It may be further added on this point that the chemical constitution of guano has been found to be exactly such as is to be expected from the above account of the mode of its production.

Why, it may be asked, does this substance accumulate within the eight degrees of latitude above stated only, though the sea-fowl are said equally to abound beyond these limits? This question involves a consideration both of the chemical nature of the substance itself and of the physical condition of the country in which it accumulates: it will be more naturally discussed, therefore, in a subsequent section.

Effects of guano on vegetation.—It is known to have been a common practice to manure with guano as far back, at least, as the twelfth century; and the possibility of raising crops on the sandy plains of Peru is said to depend altogether on the application of this substance.* (Humboldt.)

"In a soil of remarkable sterility, composed only of white sand and clay, it is sufficient to add a small quantity of guano to be able to reap the richest harvests of maize." (Boussingault.)

"It has been calculated that from 600 to 700 tons are annually sold in the port of Mollendo, for the use of the country around the city of Arequipa. In the province of Taracapa, and in the valleys of Tambo and Victor, the consumption should be something more; as wheat, all kinds of fruit-trees and plants, with the single exception of the sugar-cane, are manured with the guano: which is not the case with the district of Arequipa, where maize and the potato alone require it. In the district of Arequipa 3 cwt. of the guano is spread over an extent of 5000 square yards;† but, in Taracapa and the valleys of Tambo and Victor, 5 cwt. are required. The land thus manured in Arequipa produces 45 for 1 of potatoes, and 35 for 1 of maize; where wheat, manured with horse-dung, produces only 18." (Winterfeldt).

In 1828 the annual consumption of white and brown guano in Peru was estimated at 600 or 700 tons in all; but this is probably now much below the truth.

These facts afford sufficient evidence of the value of this substance as a manure in the soil and climate of Peru. It has recently, however, been imported in large quantities into this country, and has already been tried upon various crops and soils, and with highly satisfactory results. Several of these results have been obligingly communicated to me; and, as the subject is an interesting one to the agriculturist, I shall insert them in the words of my several correspondents.

1. *Experiment of Mr. Pusey.*—"The guano was applied, in the beginning of July, to half an acre of ridged Swedes, at the rate of 3 cwt. to the acre, drilled under the seed. Bones, Poitevin's manure or night-soil, dung, urate, and peat-ashes, were applied at the same time on neighboring pieces of ground. The first action of the guano was discouraging; for, on one half of the ground dressed with it, no plant came up. On transplanting into the blank spaces, the seed was found encrusted with the guano, without any sign of vegetation. This ill effect might be easily

* Mr. Winterfeldt can scarcely mean that the layer of guano is actually 900 feet in thickness: it probably climbs up the mountain side so high. Pica and Iquique are both within the latitude of 21° S., the limit assigned by Humboldt.

* We have seen how it was prized by the ancient Peruvians. About Villacori this people also manured with a species of small fish, taken in great abundance on the coast.

† 4840 square yards make an English acre

guarded against. Notwithstanding this check, the piece dressed with guano now (Nov. 11) appears to be superior to all the other plots excepting that which was dressed with dung."

2. *Experiment of Mr. Love, of Castle Farm.*—"I have made trial of the guano for rape and turnips, and in both instances, I am happy to inform you, it answered my most sanguine expectations. I mixed 14 lbs. of it, in the first trial, with 2 bushels of ashes; and although the weather was very dry, I could perceive a marked difference in the growth of the plants a few days after they made their appearance. Encouraged by my results, I next mixed 28 lbs. with 15 bushels of ashes, and applied it for turnips, by sowing it on the furrow, broadcast, and harrowing it in lightly; and, as we had frequent showers at the time, the seed soon vegetated, and the plants grew away from those on each side, and were large enough to hoe 2 or 3 days before those on the land I had manured in my usual way with dung and mould. In each case I applied at the rate of 2 cwt. per acre. The ashes I mixed with it were dry, and such as we usually obtain by burning round the hedgerows and borders of our fields. I have no doubt of its being a very powerful manure; and, on very poor soils, I think I should put on 1 cwt. per acre more than I did this summer, especially if I could not procure ashes in sufficient quantities to mix with it."

3. "*Mr. Westcar, of Burnwood, Surrey*, tried 7½ lbs. upon 5 rods of land, drilled in with barley and clover. Upon other 5 rods he applied the best farm-yard manure, at the rate of 18 loads to the acre, and sowed on these an equal quantity of the same seeds. The result was—

From dung, 18 loads to the acre 1 bushel 3 quarts.
From guano, 2 cwt. to the acre 1 " 7 "

Being a saving of expense in the manure, with an increase in the crop."

4. "*Mr. Smith, of Gunton Park*, applied 4 bushels, about 200 lbs., of guano to a statute acre; and on another equal portion of land on the same field, applied 15 bushels (6 cwt.) of bone-dust. Both were drilled into the ground with the seed wheat. The guano gave 6 quarters 2 bushels 1½ peck; the bone-dust only 4½ quarters of wheat."*

5. *Experiment of Mr. Skirving, at the Walton Nurseries, near Liverpool.*—"Three plots of ground were manured respectively with guano, nitrate of soda, and farm-yard manure; and to a fourth portion nothing was applied. All the four were sown with Italian rye-grass, on the 19th of May; and all were cut on the 2d of August last. The results were as follows:—

	Tons.	cwt.	lbs.
Guano, 3 cwt. per acre	14	15	26
Nitrate of soda, 3 cwt. per acre	14	13	37
Farm-yard manure, 20 tons per acre	13	2	96
Without manure	7	0	108

Mr. Skirving adds "that the experiment was made on poor light black soil, inclining to peat. The land was first dug over, and then the manures spread on it and lightly dug in. On account of the very dry weather at the time of sowing, the seed did not come up very soon on any of the plots, but when the rain came the crop appeared; and on the nitrate of soda and guano made more rapid progress, by a great deal, than on the farm-yard manure, and continued to do so until I was obliged to cut the crop, its luxuriance being such, both on the guano and soda, that it was all down and lodged, and injured the roots.

"The second crops on these manures will differ in point of weight, I have no doubt. At present the farm-yard manure takes the lead; the guano is next; but the crop on the nitrate is by no means making the same progress.

"I have tried the guano on several other crops, in different proportions, and all prove very much in favor of its being a most valuable manure; and the produce from it, as in the case of farm-yard manure, will be in proportion to the quantity laid on—at least, as far as 8 cwt. to the acre: beyond that, I fear, it would be too powerful for any crop."*

These are all the experiments of which the results have been transmitted to me. Though they leave very much to be desired, yet they are sufficient to show—that in the climate and on the soils of England the guano is fitted to promote vegetable growth nearly as much as on the arid plains of Peru.

Chemical composition of guano.—To what cause are we to ascribe this extraordinary effect of guano in fertilizing and increasing the produce of the land? What does it contain that renders it so grateful to vegetable life? We know that pigeons' dung and the liquid manure of the farm-yard act upon vegetation almost, if not quite, as efficiently as the guano; and as this latter substance has precisely a similar origin, we can in some measure understand from analogy only, why it should be so useful as a manure. A clear comprehension, however, of the kind and extent of its action on vegetable life, and of the circumstances under which it is likely to be most beneficial, can only be obtained from the study of its chemical constitution.

The first analysis of this substance was, I believe, published by Klaproth (Beitrage, Th. iv. p. 299); the specimen having been furnished to him by Humboldt. He found it to consist of—

	Per cent.
Urate of ammonia	16
Phosphate of lime	10
Oxalate of lime	12 75
Silica	4
Common salt	0.5
Sand	28
Water and other organic and combustible matter	28.75
	100

* Communicated by Mr. Macdonald, of St. Mildred's Court, Poultry; as were Nos. 2 and 3 also.

* These experiments would have been much more valuable had the results been given in the state of *dry hay* instead of that of *green grass*. The reason of this is, that different samples of grass from the same field yield often very different proportions of dry hay. Thus 100 stones of grass, cut from each of six different half-acres—treated with different manures—in the same field, near Aske Hall, Richmond, gave respectively of dry hay 52, 53, 36, 46, 40, and 36 stones. No accurate conclusion therefore can be drawn from the weights of the green grass yielded by the several parts of a field.

The next analysis was by Fourcroy and Vauquelin (Gehlen's Jour., vi. p. 679.) Their results gave—

	Per cent
Urate of ammonia	9 0
Oxalate of ammonia	10.6
Oxalate of lime	7 0
Phosphate of ammonia	6.0
Phosphate of ammonia and magnesia	2.6
Sulphate of potash	5.5
Sulphate of soda	3.3
Sal ammoniac	4.2
Phosphate of lime	14.3
Clay and sand	4.7
Water and organic matters	32.3
	100

If we suppose the analyses equally correct, the specimens examined severally by Klaproth and by Vauquelin differed very much in chemical constitution. That of Klaproth was mixed also with one-third of its weight of sand and silica.

To a circular, recently issued by Mr. Macdonald, the following analysis is appended, but the authority is not given :—

	Per cent.
Bone earth	30½
Sulphates and muriates	3
Uric acid	15
Ammonia.	15
Other organic matter	36½
	100

This also differs materially from the other two; and, allowing for slight errors in analysis, shows that the substance varies widely in composition. It cannot fail, indeed, to vary to some extent, according to the state of decay in which it is subjected to examination.

Of the guano which has been imported into this country a box having been obligingly sent to me by Mr. Macdonald of the average quality of that which, as he states, is likely to be hereafter brought to England, I have submitted it to a chemical examination, in reference chiefly to its economical value. It is of a brownish-red color, is evidently a very ancient deposite, and has undergone much decomposition. It consists of a powdery portion mixed with lumps of various sizes. The latter, when broken, exhibit an aggregation of minute crystalline plates, are much richer in ammonia than that which is in powder, and are freer from sand and stones. When broken up, however, the lumps speedily lose their crystalline appearance, give off ammonia even at the ordinary temperature of the atmosphere, and assume the condition of the powdery portion with which they are mixed.

1. *The quantity of sand* contained in a portion of the powdery variety I found to amount to nearly 11 per cent.; while in one lump there were present 8 per cent., and in another less than 2 per cent. The sand consisted chiefly of mica, quartz, and felspar, the debris of the igneous rocks of the coast of Peru. Occasional fragments of rock occur, of considerable size also, among the guano.

2. The quantity of volatile or combustible matters, (including the water and ammoniacal salts) which are capable of being driven or burned off by a red heat is also very variable. Thus, 4 portions, taken at random from different parts of the box, lost, respectively, 23½, 46, 60, and 53 per cent. of their whole weight; leaving an ash of a white or slightly gray color. This difference is not owing to the presence of unlike quantities of sand, for the numbers above given are calculated on the supposition that the specimens were all free from sand. Thus the first specimen lost by heating only 21½; but, as it contained 8 per cent. of sand, it would have lost, as stated above, if free from sand, 23½ per cent.

In so far as the volatile constituents are concerned, therefore, the guano which comes to this country may vary in value from 1 to 3.

3. Yet the loss by heating, which is very easily ascertained, is not a true measure of the richness of the guano in ammonia and other valuable organic matters. When reduced to powder it rapidly absorbs moisture from the air. Thus, in 48 hours, a weighed portion of a lump broken into coarse powder gained by exposure to the air 2 per cent.; another portion gained in 10 days no less than 6 per cent., and after a longer time it became perceptibly moist between the fingers. This absorption of water from the air will tend not only to depreciate the value of a given weight of the guano when brought to our humid climate, but also to cause errors in the results of agricultural experiments made with different samples of the manure.

4. I have stated above that the lump guano when crushed gives off ammonia at the ordinary temperature of the atmosphere. In hot weather this may be rendered sensible by holding over it a feather dipped in strong vinegar or diluted muriatic acid (spirit of salt,) when white fumes will be perceived; or at any time by heating the guano to 100° or 150°. By this evolution of ammonia it loses both in weight and in virtue. By drying at 150° I found a lump to lose 11 per cent. of its weight, ammonia being sensibly given off during the whole duration of the experiment; yet when it was again exposed to the air it absorbed so much water as in four days to be 5 per cent. heavier than it had been before it was exposed to heat.*

This evolution of its volatile constituents by exposure to the air is well known on the coast of Peru. From the guano island near Arica such a stench proceeds that vessels are prevented by it from anchoring near the town (Feuillé and Humboldt;) while the white guano at the present day sells in the port of Mollendo at a price more than one half higher than that which is given for the dark-gray and the red. (Winterfeldt.)

I do not know in what way the guano is shipped for transport to this country; but it is certain that were it rammed hard into casks as soon as it is taken from the mine, and so kept in this country till it was about to be applied to the land, it would neither be so far deteriorated by the loss of its volatile constituents, nor increased in weight by the absorption of water.

5. The absolute quantity of ammonia contained in the guano of Klaproth and Vauquelin is not stated. In the analysis published by Mr. Mac-

* If a little guano powder be mixed in a wine-glass with a little newly-slaked lime, ammonia is immediately evolved, and becomes distinctly sensible to the smell.

donald as above given, it is said to amount to 15 per cent.* This greatly exceeds the quantity contained in the specimen examined by myself, which gave me only 7 per cent. of pure ammonia. The same is true of the uric acid, which in my specimen did not amount to 1 per cent.† In these results a certain latitude must be allowed for necessary differences, since the older the deposite, the less rich must the guano be in uric acid and ammonia.

6. An important ingredient in the guano is the phosphate of lime, and as this substance is neither volatile, so as to rise into the air, nor soluble, so as to be washed out by the rains, it is obvious that the older the deposi e and the less volatile matter it contains, the richer it is likely to be in this earthy phosphate. Supposing each specimen free from sand, &c., the analysis of Klaproth gives 14.7 per cent., and that of Vauquelin 15 per cent., while the bone-earth in the third analysis is stated at 30½ per cent.

In two portions which I examined, the phosphate of lime amounted in the one to 29, and in the other to nearly 43 per cent. of the guano supposed to be free from sand. In regard to this substance, therefore, the guano is no less variable in composition than in regard to its other constituents.‡

7. When cold water is poured upon guano a large portion of soluble matter is taken up, consisting chiefly of common salt and of various salts of ammonia, with a very little of the urate of soda, lime and magnesia. After careful washing with water and drying at 150°, one portion left 40 and another 35 per cent. of insoluble residue, consisting of phosphate and oxalate of lime with some urate and other animal matters. It is these soluble salts which act most immediately and most powerfully when the guano is applied to the growing crop. The earthy constituents, though of great importance to the ultimate growth and health of the plant, begin to manifest their influence at a later period.

8. I have not thought it necessary to determine with accuracy the relative proportions of the oxalic and carbonic acids, or of the several salts of ammonia, in a substance so variable in its constitution. In the only specimen in which I sought for it I detected no sensible quantity of potash. It is true that Fourcroy and Vauquelin found 5½ per cent. of sulphate of potash, but this can only be considered as accidentally present in the specimen they examined, since it is not easy to understand how potash should be more abundant than soda in the excrements of sea-fowl, living almost entirely upon the fish of the Pacific Ocean.

9. Finally, the variable constitution of the guano brought to this country, and now offered for sale in England, will appear by the following *general* results of the analysis of two small portions taken at random from a box containing about 20 pounds' weight. The first contained 8 per cent. and the second only 1 1·5 per cent. of sand.

1.	per cent.
Water, salts of ammonia, and organic matter expelled by a red heat	23 5
Sulphate of soda	1·8
Common salt, with a little phosphate of soda	30·3
Phosphate of lime, with a little phosphate of magnesia and carbonate of lime*	44·4
	100

2.	per cent.
Ammonia	7 0
Uric acid	0·8
Water and carbonic and oxalic acids, &c. expelled by a red heat	51·5
Common salt, with a little sulphate and phosphate of soda	11·4
Phosphate of lime, &c.	29 3
	100

On the cause of the fertilizing action of guano.—Though so variable in composition, however, the nature of the substances it appears always to contain enables us to explain why it exerts so marked an effect on the growth of plants, as well as to answer one or two other questions—in regard, for example, to the duration of its action in fertilizing the land—and to the cause of its accumulation on the coast of Peru.

1. The most important and most active ingredient contained in the decomposed guano imported into this country is the ammonia. This substance, there is reason to believe, acts in a most energetic manner upon vegetation in every climate—it is one of the most useful ingredients

* Fifteen per cent. of pure ammonia are equal to 60 of bicarbonate of ammonia, 45 of sal ammoniac, or 40 of oxalate of ammonia. As much of the ammonia in guano exists in the state of bicarbonate, I doubt if any of the specimens which come to this country can ever contain so much as 15 per cent. of pure ammonia.

† One hundred grains of guano distilled with dilute caustic potash, and the ammonia received into dilute muriatic acid, yielded, on evaporation at 212°, 21.5 grs. of sal ammoniac, equal to about 7 grs. of ammonia. The uric acid was separated by boiling in dilute caustic potash, and precipitating by dilute sulphuric acid.

‡ Boussingault, after describing the astonishingly fertilizing action of the guano on the plains of Peru (Annales de Chim. et de Phys., lxv. p. 319,) says that it consists of urate, oxalate, phosphate, and carbonate of ammonia and *some earthy salts*. This distinguished philosopher, to whom modern agriculture owes so much, inclines to the hypothesis "*that the fertility of the soil can be increased only by the addition of substances containing nitrogen.*" (ibid. lxvii. p. 16,) and therefore pays less regard to the earthy matters which may be added to the soil. We are indebted to Sprengel for illustrating the important influence of inorganic substances in *nourishing* and promoting the growth of all living vegetables.

* The results above given indicate the proportions of the alkaline and earthy salts as they existed in the ash that was left when the guano was heated to redness in the air. The chemical reader will understand that very different numbers would have been obtained had the soluble salts been separated from the insoluble before either of them was heated to redness. This arises from the circumstance that, when the crude guano is heated, the phosphate of ammonia and oxalate of lime are simultaneously decomposed, and phosphate of lime is formed, whereas, were the phosphate of ammonia previously removed by washing, the oxalate of ammonia would, by the burning, beconverted only into carbonate. With a view to a merely *economical* object it did not appear to me necessary to enter into a rigorous examination of the relative proportions of the several salts of ammonia present in such variable quantities in the guano.

in our farm-yard manures, and though writers differ in opinion as to the amount of influence actually and constantly exercised by this compound on the *general vegetation of the globe*,* they all agree in attributing to it a very beneficial action on growing plants in general, when applied to them in a sufficiently diluted state. In proportion, then, to the quantity of ammonia it contains will the value of the guano be increased, and hence one reason why the more recent varieties should be accounted the best, and should bring the highest price in the market.

2. Next to the ammonia, or perhaps equal to it in value, though in the specimens I examined very much less in quantity, is the uric acid. This substance, as it decomposes, gives rise among other products to the formation and evolution of ammonia in considerable quantity. Under the most favorable conditions 100 of pure uric acid *might* yield 40 of pure ammonia. In nature, however, these conditions probably never occur, so that during its decomposition, numerous other products containing nitrogen are formed (prussic acid among the rest,) which it is unnecessary here to specify. We know little that is certain in regard to the action of these products on the growth of plants, but the well-known effect of liquid manure, which in a state of fermentation contains the most of them, leads to the belief that they are fitted to promote vegetation.

The *fresh* guano is more valuable, chiefly because it contains more of this uric acid in an undecomposed state. We have no analyses of the recent droppings of any of the birds which frequent the shores of Peru; they would probably be found to differ in some degree, not only with the species of bird, but also with the kind of fishes on which at different seasons of the year they were found to prey. We possess analyses, however, of the excretions of other birds which live chiefly upon fish, from which we are enabled to form an opinion as to what the recent guano is likely to be. Thus Dr. Wollaston found those of the gannet, (Pelicanus bassanus,) when dry, to contain little else but uric acid, while in those of the sea-eagle, Coindet found—

Solid Excretions.

Ammonia	9·2
Uric acid	84·65
Phosphate of lime	6·13
	100

Liquid Excretions dried.

Uric acid	59
Earthy and alkaline phosphates, sulphates and chlorides	41
	100

If we compare the first of these results of Coindet with the constitution of the guano as it is imported into England, we cannot fail to be struck with the degree of decomposition which the latter must have undergone—supposing it to have originally resembled the solid excretions of the sea-eagle. The quantity of phosphate of lime in the latter, 6·13 per cent., is unusually large for the excrement of a bird; but if we suppose the recent guano in its dry state to have contained quite as much, it would require 500 lbs. of the latter to give the quantity of phosphate (29·3 lbs.) contained in 100 lbs. of a quality such as the one portion I examined, and 700 pounds to yield the quantity of phosphate (44·4 lbs.) contained in the other. In other words, from 1·5 to 1·7 only of the original organi animal matter remains in the guano, as it is imported into England. It probably retains even less, since it has unquestionably absorbed from the air a considerable portion of moisture not supposed to be present in the droppings when recent and carefully dried.

It is easy to see therefore why the *recent* guano should bring so much higher a price on the coast of Peru; why the ancient Peruvians should have so carefully collected it, and should so religiously have preserved the sea-fowl from destruction or disturbance; and why they should have left the ancient accumulations comparatively undisturbed; to be searched for and excavated in these after times when the produce of the living birds has become less abundant or is less carefully collected and preserved.*

On the other hand, in the identity of the substances contained in guano with those always found in the recent excretions of living birds, we have that evidence of a common origin—which in a previous part of the present paper was stated to lend an almost unnecessary confirmation to the evidence there adduced in regard to the source from which the accumulations, on the shores of Peru, have unquestionably been derived.

One other remark I may here venture to introduce. We are astonished—even geologists, who are familiar with extended periods of time, and are accustomed to contemplate immense results produced by the prolonged action of apparently insignificant causes—even geologists are struck with the occurrence on the existing surface of the globe of such vast accumulations of excrementitious matter: yet how are our ideas still further magnified in regard both to the number of birds necessary to deposite them, and to the lapse of time during which they must have been gathering, when we learn that what now remains is not —either in bulk or in weight—more than an eighth or a tenth part of that which originally fell from the flocks of living sea-fowl!

3. A most important part of the composition of the guano is the quantity of phosphoric acid it contains in combination with ammonia, with soda, and chiefly with lime. All plants require for their healthy growth a portion of this acid in combination with lime. All vegetable productions which unmixed are capable of feeding and nourishing animals must contain it, since from their vegetable food all animals ultimately derive those earthy and other phosphates of which so great a part of their bones consists, and which

* The prevailing views on this subject, and the reasons on which they are founded, are explained in my 'Lectures on Agricultural Chemistry and Geology,' part i. p. 248.

* The comparative value of the *recent* droppings of birds is shown by the price usually paid in Flanders for pigeons' dung. It is there employed as a top-dressing for the flax, and the dung of 100 pigeons is worth about 20s. a year for this purpose—(Sprengel.) The injurious effect of recent goose-dung arises from its falling on the grass in too concentrated a state. When diluted by a shower of rain its influence is most beneficial.

are also present in smaller quantity in their fleshy parts, and in their various fluids.

The presence of these substances therefore enables the guano to minister *to a greater number of the wants of living vegetables* than it could do were it entirely composed of uric acid or of ammonia. These latter compounds may abound about the roots and leaves of plants, and yet, if the phosphates be wholly absent, the plant which sprung up of a bright green, and shot forth with vigor, will never attain to a healthy maturity, or produce an adequate return of nourishing food.

One of the uses served by bones when applied to the land is to yield the phosphate of lime they contain to the successive crops which are grown during an entire rotation. Hence one reason why the effect of bones upon the land is in many cases found to be so very permanent. The animal matter in bone dust will decompose and disappear in great measure from the soil in one or two seasons, but the bone earth (the phosphate of lime) remains long in the land, is—in small quantity only, and therefore slowly—withdrawn from the soil by the crops and by other natural agencies. and thus may continue to exercise a beneficial influence on the fertility of the field to which it is applied for a long period of time.

The same remarks apply to guano. On an average, 150 lbs. of guano may contain as much bone earth as 100 lbs. of bones ;* and in the same proportion will its action on the land, compared with that of bones, be permanent—in so far as this ingredient is concerned.

The fact is of great practical importance. Nitrate of soda, so much used of late and so deserving of more extensive trial, may be washed out of the soil where the earthy part of the guano would remain ; it may cease to exert a marked influence after a single crop, where it is scarcely possible that the phosphates of the guano should cease to act ; and it may fail to bring to maturity crops of corn or to fill the ripened ear, when the guano would supply to the grain, among other substances, the earthy phosphates also, which the seed contains as a necessary constituent.

While then the ammonia of the guano promotes the early growth, its phosphates supply to the ripening plant the materials which are indispensable to its perfect developement. The nitrates also, like ammonia, aid in a remarkable degree the growth of the plant in its earlier stages ; but, except the potash or soda which the nitrate may contain, it can supply to the maturing vegetable none of the inorganic substances it is known to require. Unless these are present in sufficient quantity in the soil, the healthy appearance of the young plant, whether imparted to it by the agency of ammonia or by that of nitrate of soda, cannot be safely trusted to as an index of the weight of corn we are to reap, when the time of harvest comes.

4. The presence of common salt in the guano need not surprise us. It is no doubt derived from the sea, partly through the medium of the birds themselves, and partly from the evaporation of the salt spray, continually driven upon the coasts by the winds. It is variable in quantity, as we should expect from a knowledge of its origin. The beneficial effect of common salt when applied to the land has been frequently recognized in many localities and upon many soils. It no doubt aids the other ingredients of the guano in producing its full effect upon the living vegetable.

The important influence of guano, therefore, on the vegetation equally of England and of America, seems to depend upon two circumstances—1st, on its containing a well-tempered mixture of a *great number* of those substances which the plant requires for its perfect growth and developement ; and—2d, on this admixture including a considerable proportion of a substance (ammonia) which in a remarkable degree hastens the growth of the *young* plant, as well as of another (phosphate of lime) which is necessary to its healthy and perfect *maturity*.

In the arid plains of Peru, where dews are rare and rain scarcely ever falls, we can easily appreciate the value of a substance which shall make the young plant as it were rush up when a favorable day of moisture comes, shall facilitate its rapid after-growth, and shall supply the materials necessary to its perfect maturity ere the burning sun and parching winds have time to scorch and wither it. Useful as it is likely to prove in our climate, therefore, the beneficial effects of guano may never be so striking in these latitudes as they have long appeared on the shores of Peru.

The cause of its accumulation on the coast of Peru.—Connected with this last observation is the explanation of the accumulation of the guano on the coast of Peru. I have already stated that, according to Humboldt, it is met with only between the 13th and 21st degrees of south latitude, though the sea-fowl are equally plentiful both to the north and to the south of these parallels. The explanation of this apparent anomaly is to be found in the climate of this part of South America.

Nearly the whole of the land along this coast, between the Cordilleras and the sea, is one continued desert. "I have always," says Mr. Darwin,* "applied the terms barren and sterile to the plains of Patagonia, yet the vegetation there can boast of spiny bushes and some tufts of grass, which is absolute fertility to any thing that can be seen here," (the neighborhood of Copiapo.) "In Peru real deserts occur over wide tracts of country." "It has almost become a proverb that rain never falls in the lower part of Peru." "That much rain does not fall is very certain, for the houses are covered only with flat roofs made of hardened mud ; and on the mole (at Callao) ship-loads of wheat were piled up, and are thus left for weeks without any shelter."† "The town of Iquique contains about 1000 inhabitants, and stands on a little plain of sand at the foot of a great wall of rock 2000 feet in height, which here forms the coast: the whole is utterly desert. A light shower of rain falls only once in very many years ; and hence the ravines are filled with detritus, and the mountain sides covered by piles of fine white sand, even a thousand feet high."‡

It is the dryness of the climate then which has permitted the guano to accumulate on these coasts. When we reach a region in which from

* Four cwt. of guano as much as 7 bushels of bones, supposing the guano to contain about 35 per cent. of phosphate of lime, which is less than the mean of the specimens I examined.

* Researches in Geology and Nat. History, p. 428.
† Ibid. p. 446. ‡ Ibid. 442.

local causes the dews are heavier and the rains more frequent the accumulation ceases. Cold water, we have seen, dissolves at least three-fifths of the guano in the state in which it reaches us. A single day of English rain would dissolve out and carry into the sea a considerable portion of one of the largest accumulations; a single year of English weather would cause many of them entirely to disappear.

When the recent guano falls it gradually dries and undergoes a partial decomposition. When it is again moistened by an unusual dew, or by an accession of spray driven by the wind, it again suffers a further partial decomposition, till at length it has given off, as the ancient red guano appears to have done, from five-sixths to nine-tenths of all the organic matter it originally contained. Mr. Winterfeldt states that this ancient guano is found buried beneath layers of sand; and Iquique is mentioned as one of the spots where the guano occurs. At this place, according to Mr. Darwin, the drift-sand climbs up the mountain-sides in great piles to the height of even a thousand feet. This, doubtless, is the sand beneath which the old droppings of the sea-fowl have been gradually buried; and to this ancient superficial covering it may be owing, that the buried masses still retain so much of their original organic matter. Even in that dry climate the time would at length arrive when the guano, long exposed to the agency of atmospheric causes, would retain only its earthy and non-volatile saline ingredients.

(*To be continued.*)

THE FALSE PRETENCES OF THE BANKS OF PREPARING TO PAY SPECIE, AGAIN EXPOSED.

From the Bank Reformer.

In the pamphlet on the "Abuses of the Banking System," and also at page 3 of the Bank Reformer, there were presented general statements, copied and digested from the official reports of the banks of Virginia, which showed, as clearly as facts and figures *could* show, the truth of what we had been continually setting forth, to wit: that the banks were *not preparing to resume specie payments*—nor even approaching the state of readiness to pay, by the only possible means of getting ready, which are, *reducing their loans and circulation, and increasing their specie.* The reports of the three principal banks of Virginia, and their branches, showing their condition on July 1, 1841, (published at page 3 of the Bank Reformer) showed that their condition was worse then than 6 months before. And the reports of January 1, 1842, just published, show that their condition, in comparative amounts of means and liabilities, continues much *worse* than on January 1, 1841, after another year of suspension, and of *pretending* to prepare to pay specie. The table below embraces only the three principal banks of Virginia and their branches. The reports of the small western banks have not been yet published. It is presumed however that these now presented, make at least as good an exhibit as the smaller banks, not here embraced.

TABLE, SHOWING THE COMPARATIVE CONDITION OF THE BANK OF VIRGINIA, FARMERS' BANK OF VIRGINIA, & EXCHANGE BANK OF VIRGINIA, ON JAN. 1, 1841, AND JAN. 1, 1842,

In regard to their respective rates of outstanding debts, circulation, and specie.

	OUTSTANDING DEBT.		DIFFERENCE	AMOUNT OF SPECIE.			NOTES IN CIRCULATION.		
	JAN. 1, 1841.	JAN. 1, 1842.		JAN. 1, 1841.	JAN. 1, 1842.		JAN. 1, 1841.	JAN. 1, 1842.	
BANK OF VIRGINIA,	5,271,538 08	5,352,713 89	INCREASE. 81,175 81	901,021 66	824,110 02	DECREASE 76,911 64	2,798,385 43	2,790,195 76	DECREASE. 8,189 67
FARMERS' BANK,	4,780,696 83	5,026,402 84	INCREASE 245,706 01	686,262 08	764,798 23	INCREASE 78,536 15	2,295,820 50	2,666,278 50	INCREASE. 370,458 00
EXCHANGE BANK,	2,068,975 06	2,409,555 80	INCREASE 340,580 74	277,502 15	248,256 41	DECREASE 29,245 74	703,860 00	722,575 00	INCREASE. 18,715 00
			Total Increase. 667,462 56			Total Decrease. 27,581 23			Total Increase. 380,983 33

The proportion of circulation to coin, in the said banks, in 1841 and 1842:

	Jan. 1, 1841.	Jan. 1, 1842.
Bank of Virginia,	$3.10 to $1 coin.	$3 38 to $1
Farmers' Bank,	3.34 to 1 "	3.50 to 1
Exchange Bank	2.53 to 1 "	2.90 to 1

From the above statements, made from official reports, it therefore appears that the three great banks of the state have, during 1841, (on an average,)

Increased their outstanding debts	$667.462 56
Increased their circulation,	380.983 33
Decreased their specie,	27.581 23

Nothing can possibly more plainly show, than these and earlier comparative statements which we have before published from the official reports of the banks made by their own officers, the inconceivable folly and stupidity of those persons who yet continue to believe that the extending the times of indulgence to suspended banks will have any effect in causing the banks to *prepare* to pay specie. Such stupidity in believers can only be equalled by the unblushing falsehood and knavery of those who *knowing the falsehood and absurdity* of such pretences, continue to urge the enactment of extended indulgence to bank suspension of payments, *as the proper and sufficient means of the banks' preparing to pay specie.* We have, for the last year, been telling the self-evident truth on this head, but it was to the ears of those who would not hear—and laying it before the eyes of those who would not see, even if the truth were as manifest as the noon-day sun. We have no hope now of inducing many to mark what we now again set before them, though it be taken from the reports of the banks themselves.

But though figures, in these condensations of statistical and official reports, show at a glance the general and important truth that we have tried so much and in vain to establish, there is no need to resort to such testimony, for the purpose of knowing that such *must* be the result, from the nature of things and the nature of man. The directors of banks, and those who most influence directors, have every operating inducement, of interest and feeling, to keep the banks *unprepared* to resume payment; and no inducement whatever to make preparation, save the mere cold and feeble dictates of right, justice, and moral obligation, even if these were not generally and entirely obscured and silenced, by the stronger promptings of interest and feeling. The greater number of bank directors, are also regular *borrowers*, and the *largest* borrowers from the banks. Though they take the lion's share of the loans, they cannot take *all*; and therefore, that they may get as much as possible for themselves, they are obliged to let other claimants be also supplied. Thus, while avarice urges them to continue expansion to supply their own wants, and, as an excuse for this, to supply the demands of other borrowers, the whole procedure is concealed under the plausable disguise of friendly sympathy for the wants of individuals, and of a public-spirited sustaining of the trade and business and general weal of the community. Again—to keep the banks totally unprepared to meet specie payments, and to keep the greatest number of debtors in the greatest possible danger of ruin, by sudden and heavy demands for payment, is the condition of things which serves precisely as the great and always unanswerable argument to the legislature to postpone for another year the resumption of payments—as resumption must always be disastrous to the banks and to their debtors, if commenced when totally unprepared for, either by the banks or by their debtors.

If, then, there were no other reason whatever operating on bank directors, and the borrowing class which control directors and banks, and all others who likewise desire the continuation of suspension, would they not certainly endeavor to maintain (as they do) the state of total *unfitness* of the banks to resume, as the sure means of obtaining further indulgence for continued non-payment? The idea that extending to the banks the time of indulgence of non-payment will alone serve to induce them to make preparation to pay, is so absurd and ridiculous, that no intelligent man, but a bank director, or a bank borrower, would have the hardihood to assert it, or to pretend to believe it *himself*, unless to convince an auditor deemed stupid enough to be imposed on by the grossest possible delusion.

In conclusion—we repeat, that if it be honestly desired by the legislature to compel the banks to return to specie payments, the only and the certain means will be to STOP THEIR MAKING LOANS, as well as declaring dividends. If this had been done in 1837, with a very slow and lenient curtailment of the existing debts, the banks would have resumed specie payments in two years at farthest, and might now be in as sound condition as the banks of South Carolina, which are all specie-paying, and in good credit. Even now, though nearly five years have been lost to this object, by foolishly or knavishly leaving it to fraudulent banks to stop their own legalized and profitable frauds, yet even now, if this policy were adopted, it would bring about specie payments in less than a year, and much sooner than any other legislative requisition and penalty whatever. And without thus stopping or greatly limiting of loans, the banks of Virginia *never will* pay specie, until forced into liquidation, or driven by general want of confidence into avowed bankruptcy.

IRISH POTATOES FROM SEED.

From the London Farmers' Magazine.

Squeeze the mucilaginous pulp with the seed out of the "apples" into a basin containing a weak solution of soda or common potash (lukewarm,) when on stirring the mixture, the mucilage will dissolve, and allow the seeds to fall to the bottom; they may then be drained or strained out, and washed in clean tepid water—strained again, left to dry on a cloth, and hung up in paper bags to the kitchen ceiling till March, when they may be sowed in beds of light rich earth, prepared in the usual way for small seeds. The writer found it the best way to sow them in drills at one foot asunder, for the convenience of weeding, &c. They should not be sown thick; they will grow very freely. When the leaves and stalks are all withered (the early kinds will be months before others) they must be taken up and preserved in boxes of sand, or very light, dry earth, till the following spring, when they may be planted (whole) in small drills in the usual way, about 1½ or 2 in-

ches apart in the drills. With proper attention they will attain a good size; and when gathering, can be sorted and named according to fancy, as there will be a numerous variety. The earliest kinds, will be first withered, the later ones generally attain a larger size. W. C.

REMARKS ON THE AGRICULTURAL SOCIETY OF THE UNITED STATES.

To the Editor of the Farmers' Register.

February 9th, 1842.

In publishing the constitution of the "Agricultural Society of the United States" and a list of its officers, I perceive that, although you say "*you shall heartily rejoice*" if "*your anticipations and fears*" of its failure "*should prove to be unfounded*," you have added an argument against the plan, which, notwithstanding its brevity, will as certainly prevent such hearty rejoicing from ever taking place, as if you most anxiously desired to defeat the project altogether; that is, should this argument have the same effect on the minds of others which it has produced on your own. Indeed, I cannot even imagine any more effectual way fairly to kill any scheme which depends upon public opinion, than publicly to use the strongest reasons we can think of against it. Your argument, concise as it is, not only gives the substance of all the most plausible objections which have been urged against this society, but you have much increased its force by pronouncing the plan to be "*ambitious*." Now if this be true of the plan, it must be equally so of its authors; and must utterly condemn both in the minds of all who affix the same meaning to the term "*ambitious*" that I do.

It is at all times a matter of so much regret with me, where I find we differ in regard to any of the means for promoting the great cause to which we have both devoted ourselves, that I would never express such difference, unless urged to it by some motive much stronger than ordinary. True it is, that we have very generally concurred in our opinions relative to those means; and therefore it increases my present regret to perceive how widely we differ respecting the "Agricultural Society of the United States." But, connected as I am with that association, I feel it to be my duty to endeavor to refute the arguments which you have urged to prove that "it can not possibly *work right*." Your first objection is in the following words: "It cannot be expected that any considerable number of individuals, or enough to maintain even the semblance of a United States Agricultural Society, can be induced to travel to Washington, from all the states of the union." This objection would have some force, if any such expectation had been expressed, and its realization relied upon as essential to the maintenance of such society. But not having heard of any thing like it, I cannot believe it ever entered into the heads of any of the contrivers of this "ambitious plan," (if you will have it so,) that some members "*from all the states of the union*" must always attend, "*to maintain even the semblance of a United States Agricultural Society.*" Such attendance you call "*incredible sacrifices*;" but admitting the bare possibility of their being made, you ask, "what could be expected from their meeting, more than the usual and almost useless procedure of agricultural societies in general?" I will readily answer, not much more truly, if "*agricultural societies in general*" (of which we now have some hundreds, I believe,) were indeed the "almost useless" things which you here affirm that they are. But we have sanguine hopes that more, much more *may* and *will* be done; for we cannot discern the same difficulties that you see, in the way of its accomplishment. None of us deem it necessary to success that "*members from all the states of the union*" should attend, since we know that there are at least two large societies embracing all the states of our confederacy, which have been flourishing for many years, without any such general attendance. I mean the American Bible and Missionary Societies; not that I would compare these noble associations with ours in point of utility—far from it; but I mention them solely to prove that large societies, even more comprehensive than ours, may and do succeed to a very great degree, although but partially attended by their members. All that is necessary is, that there should be sufficient intelligence, zeal, and activity in a few to devise and direct their operations; and that funds enough should be contributed to accomplish such of their purposes as require money to achieve them. Such funds have always been collected by the societies referred to, without the personal attendance of more than a few, comparatively speaking, of their contributors, and they have also been applied in a way, not only to do great good, but to be approved by the absent as well as the attendant members. There cannot, therefore, be any reasonable doubt, but that our society might flourish in the same manner, and by similar means, even although its meetings were attended only by a small portion of its members compared with the whole number.

There is, however, a moral certainty that these meetings never will be small, if held, as we design to hold them, during the sessions of congress; for many of the members of that body are also members of the Agricultural Society of the United States; and it can hardly be doubted that numbers of persons from the adjoining states will also attend, more than enough altogether to carry on the business of the society quite as efficiently as any institutions of the kind in our country have carried on theirs. But time alone can prove whose anticipations are correct, yours or mine.

That such an agricultural society, as you imagine could possibly be formed in the District of Columbia, might be there established, I presume no one can doubt who has any knowledge of its citizens. But if these associations have so wofully failed, as you say they have, almost every where else in the United States, there surely is but little probability that one would do any better in or about the city of Washington. Admit, however, that it would, and that it succeeded far beyond any which has ever yet been established among us; there are certain things all-important to the general improvement of American husbandry, that no local society whatever could possibly achieve. These are, first, to form a body of husbandry for the whole union, by collecting and publishing all that is at present known and most approved throughout the different states, in every branch of rural affairs. This important duty will

be assigned to the vice-presidents of the society, and so far as I have any knowledge of the gentlemen already appointed, none are more capable of executing this duty well. A single report from each in regard to his own state would at once effect the object, after all were properly collated and arranged for publication; and annual reports afterwards would make public all the improvements which are constantly being made throughout our country, and which in no other way, probably, could so soon, (if at all,) become generally known to the whole body of the yeomanry of the United States. If the vice-president of any particular state should not possess all the requisite information, it is presumable that he could readily obtain it from the district and county societies which, I believe, are now established throughout the union, and whose members, in all probability, would take peculiar pleasure in furnishing it, when they knew the highly important and national purpose for which it was sought.

The second great object which our society will endeavor to accomplish, and which no local society can possibly effect, will be to ascertain, by fair and full trials, the comparative merits of all the most approved machines and implements used for the various purposes of husbandry; and then to make the results as public as possible. This would soon have the effect of checking, if it did not entirely stop the sale of the numerous "catch-penny" things, which their owners, at present, very often succeed in selling throughout our country, to the immense injury of ignorant purchasers; for the awards of such a society would, in all probability, be deemed the best attainable evidence of merit or demerit in all such articles, by every person who saw them for the first time, and of course could know nothing of their real value.

In the last place, such a society as ours, however partially attended, would certainly make our brethren, in the distant parts of our confederacy, sooner and far better acquainted with each other, than any other means that are at all likely to be resorted to; and would thereby contribute much towards strengthening those bonds of fraternity, the preservation of which is absolutely indispensable to the welfare and happiness of the United States: without those ties our union must prove nothing better than a "rope of sand."

These, my good sir, are my principal reasons for differing from you so entirely in regard to the Agricultural Society of the United States. They are the result of long and most deliberate reflection, made, too, many years ago, and before I had any the slightest expectation that such society ever would be formed, or that I should have any office in it. Of course, no "*esprit du corps*" has dictated them. Time alone (as I said before) can prove which of us is right—you or I. But of one thing I feel quite as certain as if it had actually happened. It is, that if your anticipations and fears should prove unfounded, however "heartily you may rejoice" at it, you cannot possibly do it more than will your old friend,

JAMES M. GARNETT.

[We were reluctant to express the opinions which are here censured by our highly esteemed friend and correspondent, and will not add a word of replication, nor say any thing in reference to the opposite views presented above. We will merely repeat, that we shall not only rejoice, but shall be ready to acknowledge our error, if the anticipations should prove false, which, being entertained, we thought truth and candor required us to express; and which were desired to be expressed in terms the most respectful, as truly felt, for the members of the society.

The application of the term "ambitious" to the plan of the society was by no means meant in an offensive sense, nor supposed obnoxious to any such construction. It was used merely in regard to the very wide ground and sphere of operations assumed by the society; and such ambition was noble and praiseworthy for its motives, even though the practical course might prove to be injudicious and inefficient.—ED. F. R.]

HINTS AND OBSERVATIONS.

For the Farmers' Register.

Raising of lambs.—Build a pen upon the plan of a pig pen. Leave a hole for the lambs to enter. Have a trough to put bran or meal in. It will be necessary for you first to catch the lambs, and put the bran in their mouths two or three times. They will learn to eat when five or six days old; and at the time (say 15 days old) when they generally die for the want of milk, they can live without the aid of the mother. I have had them to run in as readily as pigs.

All stock ought to be housed. They will make much more manure, and live upon about one half the food.

Sheep.—The Merino sheep, with a mixture of the long wool, is best for family use.

Cattle.—A small cow can live well upon long or short grass; but a large one cannot prosper upon short grass.

Tobacco, I think, is not as great an exhauster as corn, the roots running much deeper, and fewer near the surface.

Hemp is a very profitable crop. It will grow, upon good land, from 7 to 12 feet, and is considered an improver.

Flax is an exhauster, but a profitable crop. I have known, from two bushels' sowing, between 30 and forty bushels seed made, worth $1.25 per bushel, and 330 pounds of flax from the swingle, worth 10 cents per pound.

The oat crop is considered injurious to sandy lands, but the clay soil seems to be benefited by it.

Buckwheat is considered a very uncertain crop, at times very productive, and a great exhauster of lands.

The turnip is considered a productive and beneficial crop, but the greatest exhauster of any thing sown upon the soil.

Grasses.—The herds-grass is better adapted to wet land, and also upon high sandy land, than any other I have tried.

Timothy will make the heaviest crop of any grass upon moist land, and grows well upon high manured land.

Orchard grass grows luxuriantly, and I consi-

der it the best grazing grass that I have ever seen.

Wheat sown out of season.—I sowed in my garden a peck of the Baltimore bearded wheat, about the first of April. There were a few indifferent heads in July or August. I let it remain. It lived over the whole summer, which was dry, and I cut it the next 4 h of July, as good wheat as you ever saw, but not so thick.

Prince William, Va. R. FOSTER.

COMMENTS ON ARTICLES ON BERKSHIRE HOGS.

To the Editor of the Farmers' Register.

I have thus far stood aloof from the controversy, which has been going on between the breeders of the different kinds of hogs, which they are anxious to put off upon the public. Perhaps I ought to pursue the same course still. But there are certain communications in your last (January) number, which I think ought not to be passed over without comment. And here let me assure your readers, that I do not undertake this thing in the spirit of controversy. I shall take sides with neither party. My sole object is to correct certain mis-statements or *mistakes*, if you choose, which, in my opinion, are calculated to mislead the public.

On p. 30, a writer, whose signature is R. S. B., uses the broad assertion, "that the Berkshires are not what they are cracked up to be." And in proof goes on to assert, "I have a neighbor who has given them a fair trial, to which I have been an eye-witness. The experiment was made in this way:—two Berkshires were placed in a stable with two of the common breed, all of the same age, and were carefully fed, and at the end of nine months were killed, and the result was, that the common breed exceeded the Berkshires in weight, one fifty and the other sixty pounds." Here it must be admitted, is a very formidable assertion. But without intending to impeach R. S. B's. candor, I must say that the trial was by no means "a fair one." Every one must have observed the difference in thrift of hogs of precisely the same breed. And even in the same litter of pigs, there is often the most striking difference, some growing off rapidly, whilst others are puny and weak and not worth raising. Now, in the present instance, all that we are told is, that the hogs were equal in numbers, equal in age, fed the same length of time and on the same food, and that at slaughtering the common hog greatly exceeded the Berkshire in weight. Now, without calling one of these facts in question, allow me to inquire, may not the increased weight of the common hog be accounted for, on some other principle than his superiority? Perhaps he may have been more healthy, and therefore more hearty; perhaps the Berkshires were stinted when young, a misfortune from which they never recover; or I can conceive twenty other *perhapses* on which I can account for the difference. But I have already alluded to a litter of pigs, in which there is no difference in breed, but still a great difference in thrift. Now, when R. S. B. will account for this difference, I will do the same in his case.

But R. S. B. presents another formidable objection to the Berkshires. "They are not prolific: a gentleman of my acquaintance had four sows, each of which had but *one pig*, being a loss of at least ten per cent. a head, and the generality of them, I believe, do not get more than four or five." This objection, I confess, somewhat surprises me. I really know not what to make of it. The Berkshires have hitherto been considered as *remarkable* for their prolific qualities, and my own observation has confirmed the fact. One of my boars got on a neighbor's sow fourteen pigs, on another nineteen, and on a third, twenty-two. And in my own case, my sows breeding from this and another boar, have so many pigs, that I am constantly subjected to the painful necessity of killing them, to prevent worse consequences. I have always thought a bet a very poor expedient to establish any fact. It only proves the sincerity and confidence of the party. And as this is what I have principally in view, I hereby offer R. S. B. not a *bet* but a *barter*, that for every Berkshire sow, young or old, he can find having but one pig, I will find twenty that have five or more; and for every full grown sow, that has only five, I will find fifty that have ten or more.

There is another communication in your last number, p. 12, signed Bolling Jones, which I think requires some notice, not that it contains any mis-statements or even mistakes, but because it makes a representation which is calculated to discourage the raising of pork among us. This gentleman's hogs, it seems, cost him $22.42½ when the same amount of pork might have been bought for $14.96. Here is evidently a great loss. But let me inquire, in my turn, what line of business, in all or any of the pursuits of life, is at all times exempt from losses? Would it be considered as wise in the merchant, the mechanic, the manufacturer, or any other person, to abandon a pursuit usually profitable, simply because he had met with a loss? On this plan all trades and pursuits would be subjected to fluctuations and changes, which would eventually destroy the whole. The fact is that the last pork season was a very unusual one. I cannot call to mind the time when pork was so cheap. A variety of concurrent causes served to depress this article to a degree never known before. If Mr. Jones could have bought it last year for $4, he knows that the usual price in his county has been $6 and sometimes more. If therefore pork had continued at its customary price, a price which it will in all probability recover again, there would have been no loss even in his case. And here let me remark, that the sure and direct mode to raise the price of pork, is to do just as this gentleman has done: abandon the raising of it himself, and discourage it as far as he can in others also. If this state of things become general, we shall soon be without hogs of our own, and then the Kentuckian will charge us just what he pleases for his.

But Mr. Jones, according to his own showing, has subjected himself to full twice the expense that there was any need for in raising his hogs. His hogs, it seems, in 15 months and 5 days, "each ate 37 bushels 1½ peck of corn." Now I affirm, and that too upon actual trials, amounting to many hundreds, that 11 bushels of corn, with such other food as every farm will produce, is sufficient to keep a hog in good thrift for the first

12 months of his life, and then to fatten him in the bargain. And this I say, not from the report of a servant, but, being my own hog-herd, I know it to be a fact. This subject has already been presented in detail by me, and published in the October number of the Southern Planter, to which I refer Mr. Jones and all others who may be curious about it. I would just remark, that his great error seems to be that he had corn, and scarcely any thing else for his hogs, and hence his great expense in rearing them.

But, Mr. Editor, before I leave this subject, I have a word to say to *you*, and this in fact was my chief reason for taking up my pen at this time. At the end of Mr. Mahard's communication, page 17, you have appended a note, in which you *seem* to discourage the strenuous efforts which are now in progress to improve our stock. I say *seem*, for I cannot believe that a man who has done so much for the improvement of the soil as you have, would designedly throw one single obstruction in the way of improving our stock. In this note "humbug, humbugging, humbug forever, deception" and such like, frequently occur, as connected with this subject. Now, although I am free to admit with you, that many impositions have been practised in this matter, yet I am by no means prepared to concede that *all* is humbug and deception. I believe that among those who have imported fine animals, with the view of propagating and selling them, are many as honest, as high-minded, and as much above the meanness of deception, as any class of men whatever. I will even go further, and say, that these United States owe to these men a debt of gratitude, which they will find it very difficult to extinguish. These, I doubt not, are your sentiments as much as they are mine. Why, then, allow me to ask, cast ridicule upon a whole class of men, when comparatively few deserve it? But, sir, improvements are certainly in progress, and no representations of humbuggery, by *implication* or in any other way, can possibly arrest them. Men will see for themselves, and when the fact is obvious, they will not allow it to be controverted. When I was a boy, my father had the good judgment and kindness to require me to hold the handles of the plough. But after I commenced my little education, I knew nothing practically of this implement for about 20 years. At the expiration of this period, it was my good fortune to return to the plough again. I only regret that I did not return much earlier. But when I came to my old acquaintance, I was literally astonished at the improvement which had been effected in it. Instead of that little unsteady thing which merely *scratched* the surface, I found a solid implement, which took a firm hold on the soil, and completely inverted the sod. With this practical evidence before my eyes, and in my hands, could I doubt that an improvement had taken place in the plough. In the same manner, some years ago our hogs were a long-snouted, lank-sided, long-legged, ugly beast, requiring two or three years to get their growth, and a poor affair even then. Now I see an animal compact in form, having a large proportion of body, with leg just enough to take the necessary exercise, but not enough to fit it for mischief, and giving me more meat, and better meat, in 12 or 18 months, than the old hog did in twice that time. And shall I not call this an improvement? *You*, sir, in your zeal to prevent imprositon, may call this humbuggery; but I call it solid improvement.

Notwithstanding what I have said, I cheerfully acknowledge that the public has been sadly gulled on this subject. I doubt not that in some instances, when Brother Jonathan was hard run for a genuine pig, and strongly tempted by the $10 jingling in his hearing, he was prevailed on, *just this one time*, to send a [low] grade pig. In other instances, when there has been honesty enough to send the genuine, the inferior have been selected for this purpose, whilst the best have been kept at home. These are the cases, sir, which you so justly and severely reprehend. But in the midst of all these spurious coins, there is certainly some genuine metal; and this is all that is contended for by your humble servant,

J. H. Turner.

QUERIES IN REGARD TO PREVALENT DISEASES PRODUCED BY LOCAL CAUSES.

The following queries were drawn up at first for the consideration of the Board of Agriculture. But they were not offered by the writer, because he deemed it injudicious, at the outset, that the subjects of inquiry should be more extensive than those actually adopted by the Board. But there is no subject, not strictly belonging to practical husbandry, which has a closer relation to the interests of agriculturists, through a large part of Virginia, than the investigation of the sources of malaria, and its effects, and, by ascertaining facts, to discover any means for the prevention or mitigation of this scourge and destroyer. To invite attention to the investigation, and the furnishing of accurately observed facts, these queries are here submitted in their original form, to serve merely as suggestions. Nearly all men of observation and experience who reside in lower and middle Virginia, though knowing nothing of medical science, have by observation learned facts which would throw some light on this dark subject; and still more could be done by country physicians possessing also equal means for observation. Any accurate facts furnished on this subject we would gladly publish; and whether few or many, they will, according to their extent, form useful materials for future and more extended labors of the Board of Agriculture. We have long been convinced, and have stated the grounds of the conviction, that much of the production of the baleful effects of malaria may be prevented by a proper system of agriculture, aided and enforced by legislative enactments and strict police; and that such a system would be profitable of itself directly, and ten-fold more profitable indirectly, as serving to

lessen the losses and pain and unhappiness produced by disease and death.—Ed. F. R.

1. Is your region or neighborhood subjected to autumnal fevers, (the effects of malaria,) or any other diseases produced by local causes—and, to what extent and degree, in general?

2. What are the supposed local causes or particular sources of malaria, and their comparative injurious power—as rapid rivers and smaller streams sometimes overflowing the bordering low-lands, tide-water marshes, salt or fresh, swamps, mill-ponds, and the passage of floods from mill-ponds, at uncertain and irregular times, over salt tide marshes?

3. Have diseases from such causes increased or diminished in frequency or virulence within any certain past time, and if so, to what circumstances are the changes ascribed?

4. Can the lessening or removal of malaria and its effects be effected by the action of the residents, either operating alone, or necessarily requiring new legislation, or general police, in regard to drainage, mill-ponds, removal of nuisances, &c.?

5. In illustration, and as proof, state particularly any known facts, and the authority on which they rest, which serve to confirm the opinions expressed in answer to the preceding queries.

RECEIPT FOR MAKING SOAP.

From the Massachusetts Ploughman.

Mr. Buckminster:—I am not quite satisfied with your explanation and recipe for making soft soap. This article is a compound of potash and tallow, or grease, which union is formed in conformity with the laws of chemical affinity, and in different proportions. Whenever they are brought together in these proportions, so that their respective particles come into uniform contact, unless some counteracting substance is mingled with them, the union is inevitable and its result good soap. In order that these particles may be brought into complete and uniform contact, agitation with water is necessary.

The quantity of water required, depends on the quality of soap you wish to produce. A barrel of soap may be three-fourths water. With this quantity and the proper proportions of potash and grease, it will be very good soap. It is however more commonly seven-eighths water, and sometimes reduced much more, and then, of course, it is very inferior in quality, not that it will not do its office, and do it as well, but it does less. If this process be so simple and its result so inevitable, your correspondent wishes to know why any person who attempts it has "bad luck" and fails. There are several causes of this. A very common one is that either the potash or grease is in excess.

The former ought always to be so to some extent, to make the soap effective for cleansing whatever it may be applied to. That part of the potash which is in excess is always ready to combine with any substance which is brought into contact with it, for which it has an affinity. For animal fat of all kinds this affinity is very strong, and more or less so for all kinds of animal matter, as washwomen, who have used that which has too much uncombined potash, have often found out by its effect upon their hands. Cloth made of wool, or part wool, will be ruined by it—the affinity of potash and wool being such, that a very good soft soap can be made of them.

On the other hand, if the grease is in excess the soap is good for nothing; the alkali in the compound being already surcharged with grease, has no power for removing dirt, stains, &c.—while the uncombined grease defiles whatever it is applied to. As before remarked, for the ordinary purposes, for which this kind of soap is wanted, the potash should be in excess. If it is too much so, however, the soap, as the saying is, "will not come"—nor will it if the grease is so in the slightest degree. If either of these causes is operating to prevent its "coming," the best way to ascertain it is by touching the soap to the tongue. If the potash predominates to an extent sufficient to prevent the soap from coming into work, its effect upon that organ will be rather severe. If the potash is not felt at all, more lie must be added. But, as I have before intimated, there are other causes of failure besides these two. A very small portion of common, or any other kind of salt, or of any kind of acid, will prevent the combination desired. The former unites with the water, forms a brine and settles to the bottom, and on being permitted to cool, will leave a greater or less thickness at the top of an inferior kind of hard soap; according to the greater or less amount of grease used. Acid will unite with the potash—make a brine of the water which will settle to the bottom, and if there is enough of it in leave the clear grease at the top.

There is generally some salt in family grease unless it has been boiled upon water. Sulphate of lime or magnesia is in some wells so abundant as to render it impossible to make good soft soap with the water. The sulphuric acid of these substances having a stronger affinity for potash than for these, leaves the latter, unites with the former, and forms a salt called sulphate of potash, which being dissolved in the water forms a brine and settles to the bottom.

Again, carbonic acid, (a gas,) which is constantly floating in the air, has a strong affinity for potash, and when united with it forms a salt (pearl-ash) which will prevent soft soap from "coming." This union is constantly going on with the potash, even before it is leached from the ashes, so that if they are very old, so much of this kind of salt is formed that unless it is in some way removed, soap cannot be made of the lie. For the same reason old potash, which is on the outside of the lump, where the air has come into contact with it, will be pretty sure to disappoint the expectation of the soapmaker. This difficulty, which always occurs to a greater or less extent, must be removed, and for this purpose (not, as you seem to intimate, for "its strength") lime is used, it having a stronger affinity for carbonic acid than potash has. Consequently when they are brought into contact, the acid leaves the potash—combines with the lime and forms an insoluble substance called carbonate of lime, and is simply pulverized limestone. There are other difficulties in the way of making this kind of soap in Boston and vicinity. Coal ashes produce no potash. The same is the fact with turf or peat

ashes. Nor have the ashes of rotten and decayed wood any of this substance in them, while that which has been soaked in sea water has a portion of salt among its ashes.

One word by the way of a recipe or process in conformity with these facts.

In preparing the ashes for leaching about one peck of unslaked lime, after being slaked and completely pulverized, should be mingled and equally mixed with three bushels of good ashes, damped enough to prevent dust from rising. In this way, as you will perceive, the lime and potash come into close contact with each other, as soon as the latter is drawn from the ashes by the water which is applied for leaching them, and therefore the acid has the best possible opportunity for coming in contact and uniting with it. Lime placed at the bottom of the leach, by itself alone and unmixed with the ashes, will do the lie a great deal of good by attracting much of its acid, as it passes through, though much less than when mingled with the ashes throughout equally. Placing it upon the top of the leach is almost useless. Water can dissolve only about 1.500 part of its weight of lime; and only that lime which is dissolved while the leaching water is passing through it comes at all into contact with the potash. To put lime into the soap is much worse than useless.

Nor am I quite satisfied with your leach tub. It should be perfectly tight, with but one hole in the bottom for drawing off the lie and that as carefully stopped as your cider barrel until your lie is fit to draw off. A board with a dozen inch holes bored through it, resting upon bricks edgewise and covered half an inch thick with shavings makes a good bottom for a leach tub.

The ashes when put in should be crowded and trodden completely together, leaving about three inches of space at the top of the tub for receiving the water.

After filling in water until the ashes will take no more, it should be permitted to stand 4 or 5 hours to allow the lime an opportunity for combining with the carbonic acid. The lie is then to be drawn off, and so much of it as is under the false bottom, or between that and the ashes, should be again put upon the top of the leach, that by a second passage through the leach it may be made perfectly caustic.

Your mode of testing the strength of the lie is as good as any, unless an instrument called an alkalimeter is at hand. Lie thus made, if not too strong or too weak, will be certain to combine with the grease as soon as the mixture is warm enough to melt the grease, provided it is moderately stirred, and provided the grease is pure. This may be made certain by boiling it a few minutes with half its weight of water, and afterwards letting it stand long enough for the water to subside. With 25 pounds of such grease you may be sure of an excellent barrel of soap. SOAP BOILER.

Newton, Feb. 2, 1842.

POWDER OF SLIPPERY ELM.

From the United States Gazette.

We live but to learn and obtain knowledge. Being in the country a few days since, on a visit to a sick friend, I was shown an article entirely new to me, which is said to be remarkably nutritious and palatable for debilitated and sick persons. It was flour, prepared by the Shakers from slippery elm, and used the same as arrow-root. One table-spoonful of this flour, boiled in a pint of new milk, is excellent to feed infants weaned from the breast. They will not only fatten upon it, but it will prevent bowel complaints. It makes an easy and nutritious diet for consumptive and dyspeptic persons. From the character I received of it, I presume that it only need be known to become of general use.

DRIVING CATTLE.

I have often witnessed the infliction of cruelties on dumb beasts accused of sullenness, by persons attempting to lead or drive an animal alone. This subject was brought to mind so forcibly a few days since, by a neighbor sending a boy to lead a a heifer a distance of several miles, by a rope attached to her horns and nose, that I determined to write a line upon it. The restiveness of cattle, in such cases, is caused by skittishness. The remedy is simple and efficient. Fasten a board before the face, in the usual manner of blinding breachy* cattle, and the wildest cow or heifer may be led or driven with perfect ease.—*Maine Cultivator.*

AN ESSAY ON THE SYSTEM OF AGRICULTURE BEST ADAPTED TO KENTUCKY.

By Adam Beatty, of Mason county, Ky.

[To this essay was awarded the premium offered by the Agricultural Society of Kentucky.]

In adopting a system of agriculture best suited to the circumstances of our state, regard must be had to its variety of soil and climate. The climate of Kentucky extends from thirty-six and a half to thirty-nine degrees of north latitude. So far as regards climate, every part of the state is well adapted to the culture of Indian corn; but wheat can be grown to advantage only in the more northern parts. Indeed, even in those parts best adapted to wheat, this useful grain, except for our own immediate supply, is not found to be a very profitable crop. The new states to the north and west, in the cheapness of their lands and better adaptation to wheat from climate and soil, will always have great advantages over our state in supplying the New Orleans market. The culture of that article to any considerable extent, in Kentucky, will, in the general, be found not to be useful or advantageous, and ought, except to the extent of supplying our own wants, to be left to such of our farmers as occupy a soil not adapted to hemp and tobacco. Besides the uncertainty of the wheat crop in the rich vegetable soils of Kentucky,† it is very exhausting, and requires much

* In New England cattle are called "breachy" which break through fences.

† Liebig says, that soils particularly rich in humus are not favorable to the growth of wheat.—*Organic Chemistry*, p. 197-8.

attention to manuring and grassing of land to prevent its deterioration.

Barley is better adapted to our soil and climate, is not so exhausting, and may, in those parts of the state where there is a demand for it, be cultivated to more advantage than wheat.

In the rich vegetable soils of Kentucky, which are well adapted to the growth of hemp and tobacco, these crops, together with the necessary grains for feeding stock, such as corn, rye and oats, and the appropriate vegetables for the same purpose, should be the principal objects of culture.

Tobacco can be grown to advantage in every part of the state where the soil is suitable, but it is more peculiarly adapted to the Green River country, where the climate is better suited to the production of a first rate article.

A system of agriculture best suited to our circumstances, whilst it should embrace every variety of product, to which our soil and climate is adapted, should be so diversified as to appropriate lands of various qualities and lying in various latitudes, to the production of those articles which are best adapted to the nature of the soil and most suitable to the surrounding circumstances.

Thus lands lying near a large town or city, where the facilities for obtaining manure are very great, may be advantageously applied to the production of such articles as will serve for the consumption of the place.

By directing our efforts to the production of as great a variety of articles as the nature of our soil and climate and other circumstances will justify, we shall obtain all the advantages resulting from a division of labor, and at the same time guard against the consequences of *over production.*

If the whole energies of our state were directed to the culture of tobacco, there would not only be a misapplication of labor in attempting to produce that article in lands unsuited to the crop, but there would be an *over production,* and consequently a considerable diminution of price. If a like effort should be made to extend the culture of hemp, a similar consequence would result; and so in relation to any other agricultural product. Still greater evils would result if we were to direct all our efforts to the raising of live stock. The consequence would not only be the usual result of *a supply exceeding the demand,* but there would be a *surplus* left on hand, which would have to be fed and sustained in the hope of a *future demand* at some distant but uncertain period.

But although our agricultural efforts should be directed to as great a variety of products as circumstances will admit of, yet the *same individual* ought not to attempt the culture of too great a number of articles. In general farmers will succeed better by directing their *main efforts* to some one crop as an article for sale, and such others as are necessary to feed their stock and furnish subsistence for their families.

In one particular our system of agriculture should be uniform. Whatever may be the nature of the crops we cultivate, the utmost care should be taken so to cultivate our lands as never to suffer them to become less fertile.

Although there has been considerable improvement in our system of agriculture within the last twenty years, yet there can be no doubt we are still far behind the improvements of the age in the highly useful science of agriculture.

The extreme natural fertility of our best lands induced our early settlers to fall into the error, that it would be impossible to exhaust them. The great depth of the vegetable mould and a most excellent subsoil founded upon limestone rock, very naturally induced the opinion that it was inexhaustible. Experience has shown the fallacy of this idea, but is difficult even at this day, to make the generality of farmers sensible of the extent of deterioration which much of our naturally rich soil has already undergone; and still more difficult to convince them of the great advantages which would result from such a change of our system of husbandry as will restore our exhausted soil to its original state of fertility.

A *continued* cause of deterioration must ultimately terminate in such a reduction of soil as will render the product of less value than the labor necessary to bring it to maturity. Such a course of cultivation not only diminishes the profit of the farmer each succeeding year, until his profit is reduced to nothing, but his capital vested in land will be almost entirely sunk.

The least reflection will satisfy any one of the disadvantage of such a system. It costs no more labor to cultivate an acre of ground producing sixty bushels of corn than would be required to cultivate the same acre after it has been so reduced in fertility as to produce only thirty bushels. Now if the agriculturist who raises thirty bushels of corn per acre is barely paid for the labor expended in raising it, it is evident that the additional thirty bushels which it would have produced if the soil had not been suffered to diminish in fertility, would have been clear gain.

The same would be equally true of hemp, tobacco, and every other crop, except the small additional labor of harvesting the increased crop and preparing it for market after it has been brought to maturity.

As land can be much more easily *kept* in good heart and fertile condition than it can be *restored* after it has been deteriorated, a discreet farmer will always resort to the *easier* method, especially as it is by far the *most profitable one.*

If we take from land all or nearly all that it produces, and restore nothing, we gradually abstract from it those nourishing principles, which are essential to the growth of plants; and when the work of destruction has been carried to a certain extent, there will no longer remain in the soil a sufficient quantity of nourishing ingredients to produce a crop sufficient to pay for its cultivation. If a beneficent Providence had not made provision for a supply to a considerable extent of those elementary principles which constitute in various states of combination, the appropriate food of plants over and above what is furnished by the soil, our best lands under a bad state of cultivation would long since have been reduced to a state of complete sterility. In a state of nature every thing is restored to the soil which is drawn from it by the growth of plants, and hence it continually increases in fertility. To preserve the fertility of land while in a state of *cultivation,* it is only necessary to restore to the soil such a proportion of the fertilizing ingredients as will, together with those furnished from the atmosphere, be equivalent to the sum of those drawn from the soil by the growing crops.

The office of the soil is, "1. To receive and digest the food designed for the growing plant. 2. To serve as a medium for conveying to the spongiolets or mouths of the plants the water holding in solution the different substances which pass into and nourish them; and, 3. To serve as a basis for fixing the roots of the plants, and maintaining them in an upright position." *

The following are the most important elementary principles, which, in various states of combination enter into the composition of vegetable matter, and furnish the appropriate food for growing plants; oxygen, hydrogen, nitrogen and carbon, together with a small portion of the alkalies and oxides of various metals. So far as these elementary principles are supplied from other sources than the soil in which crops are grown, the waste occasioned by their removal is replenished. Plants possess the power of decomposing water,† and appropriating its elements by assimilation as food; and as water is composed of hydrogen and oxygen, it follows that two of the foregoing elements are derived in large quantities from the atmosphere through the medium of rain, snow and dews.

Liebig, in various parts of his able work on organic chemistry, has shown that plants derive from the atmosphere, by the absorbing power of their leaves, a large and regular supply of carbon in the form of carbonic acid. He adds that during the heat of summer, (a plant) derives its carbon exclusively from the atmosphere."‡

Here then we have the source whence is derived in large quantities three of the principal elements, which in various states of combination assist in furnishing food for growing crops. Nitrogen is known to be essential to the healthy and vigorous growth of plants. This element exists in large quantities in all animal substances, and also to a considerable extent in decaying vegetable matters, but much of it escapes in the form of ammonia during the process of decomposition. It was difficult until recently to account for the manner in which the loss (sustained by soils while in cultivation) of this indispensable ingredient of fertility, is replenished. Liebig has shown in a very satisfactory manner that ammonia (composed of three parts, by weight, of hydrogen, and 14 parts nitrogen) is combined with rain water and snow in small quantities, and hence the loss of nitrogen sustained by the removal of crops from the soil on which they grew is, in a limited degree, restored by the falling of rain and snow. Thus nitrogen, to some extent, is also supplied by the atmosphere to growing plants; but as this supply is not so abundant as that of the other elements, the utmost care should be used by the cultivators of the soil to keep their lands well supplied with this indispensable ingredient of fertility, by taking nothing from the land but what is necessary, by restoring in the form of manure every thing that can be restored, and by cultivating clover and other ameliorating crops which take but little from the soil, while they add to it all the fertilizing ingredients which they derive from the atmosphere. When these circumstances are duly considered we may readily account for the length of time during which a soil may be cultivated in the worst possible manner, without entirely exhausting it. A continued effort is made by nature to replenish the earth with those fertilizing ingredients which have been inconsiderately wasted by the improvidence of man, without any effectual effort on his part to restore even the small proportion of those ingredients which would furnish a full supply of food for future crops.

When a beneficent Providence has done so much towards restoring the elementary principles constituting the food of plants, which, to a certain extent, must be consumed by the growing crops, a strong encouragement is held out to the industrious farmer to do his part also. In looking around he beholds every where the evidence that when all is restored to the earth which grew upon it, a continued increase of fertility results. This is a sure indication that a beneficent Providence intended that the earth should never become sterile by cultivation—it plainly points out to man that he too should restore to the soil that portion of its products for which he has no use. He should continually bear in mind that the aids, provided by a bountiful Creator, were only intended to supply the *unavoidable loss* of nourishing ingredients or food for plants, occasioned by the necessity of taking from the soil a portion of the growing crops for consumption, and which cannot, therefore, be fully restored. While, therefore, the prudent farmer may confidently rely upon these aids in preserving the fertility of his soil, he will recollect that he must also do his part. He may take for consumption the fruits of the earth for both man and beast, and yet give back to it enough to keep up its original fertility, by restoring only a reasonable proportion of that part of its product which remains after consuming all that is of any value for food for himself and provender for his stock.

Next to oxygen, hydrogen, carbon and nitrogen, the alkalies, potash and soda, constitute the most important ingredients, in the food of plants. These were formerly considered as simple substances, but were ascertained, by Sir Humphry Davy, to be metallic bases, combined with oxygen. They are therefore real oxides. They are capable of combining with a great variety of substances; and, in various states of combination, form an indispensable food for plants of almost every kind. Hence if these substances were entirely extracted from the earth, it could no longer produce a vigorous growth of those plants which require a supply of these alkalies as a part of their food.

Liebig has shown, that these alkalies exist in a state of combination with water, in small proportions, and that where they have been extracted from the soil by growing plants, they may be restored by irrigation, and by rain.* Sea water also contains these alkalies in small quantities, and Liebig informs us that "the roots of plants are constantly engaged in collecting from the rain those alkalies, which formed part of the sea-water, and also those of the water of springs, which penetrates the soil." That, "without alkalies and alkaline bases most plants could not exist."†

The alkaline earths, lime and magnesia, are

* Farmers' Companion, p. 50.

† Liebig's Organic Chemistry, 122.

‡ Liebig's Organic Chemistry, p. 106 See also p. 54 and 55.

* Liebig's Organic Chemistry, 159, 160.

† See further on this subject, p. 196 to 200.

necessary to the vigorous growth of some of the most valuable agricultural products. These earths exist in great abundance, in some soils, but in others are very deficient, particularly in lime. This deficiency is, in some degree, supplied from the atmosphere. Liebig informs us that " by the continual evaporation of the sea, its salts are spread over the whole face of the earth ; and being subsequently carried down by the rain, furnish to the vegetation those salts necessary to its existence. This is the origin of the salts found in the ashes of plants, *in those cases* where the soil could not have yielded them."* Besides a small quantity of *sulphate* of lime, there is contained in sea-water, according to Liebig, 1.12400 of its weight of *carbonate* of lime.

Thus it is seen we are indebted to the atmosphere not only for oxygen, hydrogen, carbon, and nitrogen, but also for potash, soda, and the alkaline earths—lime and magnesia. The importance of these will be further noticed, when I come to remark upon manures.

The means of preserving the fertility of the soil, and renovating that which has been partially exhaused are,

1. A judicious rotation of crops.
2. The saving and applying of manures.
3. A liberal cultivation of such crops as receive their chief nourishment from the atmosphere.
4. Good tillage.

As a distinct premium has been offered for the best essay on the rotation of crops best suited to Kentucky, I do not propose, in this essay, to say any thing on that branch of the subject.

The saving and applying of manures is very important to a good system of husbandry. And great care should be taken to preserve so much of the product of the farm, as is left unconsumed by man and beast in suitable situations, to be used at the proper time, for that purpose.

The necessity for suitable application of manure, to cultivated lands, is very evident when we reflect, that some of the most important ingredients which serve as food for plants, such as nitrogen, potash and soda, are furnished but sparingly from the atmosphere. These ingredients are all found in manures ; and by properly saving and applying them, the farmer is enabled to make up the deficiency of the supply from the atmosphere. Manures contain also other useful ingredients, which, perhaps, can be derived from no other source.

A question of great importance, and one which seems not yet to be fully settled, is what is the best manner of preserving manure till the proper period of applying it to the land in cultivation, and in what condition should it be applied, whether after complete decomposition has taken place, or when only partially decomposed or in the state in which it came from the earth ? Liebig, in his able work on organic chemistry, in its application to agriculture and physiology, has shown that ammonia is a very important ingredient, in the nourishment of all agricultural products.

During the decomposition of manures, a large quantity of ammonia is formed, but being a gaseous substance the whole passes off, and is entirely lost. If, therefore, long manure is exposed in heaps to the effects of heat and moisture, fermentation ensues, and the consequent formation of ammonia, which passes off in the form of gas, and nothing is left, as he informs us, but "a mere carbonaceous residue of decayed plants." An idea of the loss sutained by manure, exposed to heat and moisture, may be proved by the fact stated by Liebig, "that with every pound of ammonia which evaporates, a loss of sixty pounds of corn (wheat) is sustained." To prevent this loss Liebig recommends "that the floors of our stables, from time to time, be strewed with common gypsum, (sulphate of lime,) the ammonia (he says) enters into combination with the sulphuric acid, and the carbonic acid with the lime, forming compounds which are not volatile, and consequently destitute of smell.*

Growing plants receive large supplies of oxygen and hydrogen (the component parts of water) from rains and dews. They are also supplied abundantly with carbon, in the form of carbonic acid, by means of the absorbing power of their leaves. But a full supply of nitrogen and the alkalies is likewise essential to their vigorous growth. These are more sparingly supplied from the atmosphere, and hence the importance of additional supplies. Putrescent manures abound in nitrogen, but this important element of vegetable food, during the process of putrefaction, nearly all escapes (if no measures are taken to fix it) in the form of ammonia.

Liebig has shown, that this may be done by a proper application of gypsum to stable manure before the fermentating process commences.† A similar application of gypsum to manure, saved in feeding pens, cow yards, &c., would, no doubt, have a most beneficial effect, but it must be remembered, that ammonia is readily absorbed by water, and consequently large portions of it may be lost, where the manure is so exposed as to become satured with that fluid. Every precaution, consistently with a due regard to economy, should be used to prevent this. Placing the manure under sheds, and intermingling with it a due proportion of gypsum, would be the most effectual way to guard againt the loss of ammonia. But in general this would be attended with too much expense. The next best method is to so place the manure, preparatory to its undergoing fermentation, as not to subject it to the drainage of the adjacent grounds, or the dripping of water from the roofs of stables, cow sheds, &c. The former object can be attained by a judicious selection of suitable ground for feeding yards, and by cutting ditches where necessary, to carry off the water. The latter may be secured by erecting stables, sheds, &c., so as to have the manure thrown out at the gable end, where there can be no dripping from the roof. Where stables or sheds have been already erected upon a different plan, the drippings from the roof may be carried off by leading troughs. These precautions would leave the manure subject only to the effects of rain falling immediately upon it. To guard against this, the manure should be kept in com-

* Liebig's Organic Chemistry, 166.

According to Marcet, sea-water contains in 1000 parts :

26.660 chloride of sodium. 4.660 sulphate of soda. 1.232 chloride of potassium. 5.152 chloride of magnesium. 1.5 sulphate of lime.

* Liebig's Organic Chemistry, 239. † Ib. 239.

pact heaps, so as to expose as little surface as possible to the falling rain; to this end the manure collected in cow yards, feeding pens, &c., should occasionally be thrown into heaps in the form of a stack, mingling therewith, during the process, a due proportion of gypsum. A still further precaution might be used, by removing the manure, as soon as it is in a fit condition, to the fields for which it is destined, and there spread. This would check any remaining disposition to ferment, and the falling rains would carry the ammonia down into the soil, with which it would combine, and thus all danger of further loss, to any considerable extent, would be avoided. From what has been said, it will be seen that manure is liable to great loss during the process of fermentation, unless the utmost care is used to prevent the escape of ammonia. If manure is suffered to undergo complete decomposition, there will be a considerable saving of labor in hauling and spreading, and much less difficulty in ploughing the ground on which it is distributed, but there will be more or less loss of some of the most valuable ingredients of the manure. If the proper precautions are used to prevent the escape of ammonia, perhaps upon the whole, it will be found most advantageous to suffer the manure to undergo at least a partial decomposition, before it is removed to the fields for which it is intended. But, notwithstanding every precaution that can be used in preserving and applying putrescent manures, some loss will be sustained. Ammonia readily enters into combination with carbonic acid, forming a volatile compound, and is itself, while in a gaseous form, with all its volatile compounds, extremely soluble in water.* And hence every particle of water evaporating from a dung heap will carry with it ammonia and carbonic acid, unless they shall have been converted into a salt, which is not volatile. Alumina (clay) exercises an indirect influence on vegetation, by its power of attracting and retaining water and ammonia."† Liebig informs us, that "a part only of the carbonate of ammonia which is conveyed by rain to the soil is received by plants, because a certain part of it is volatilized with the vapor of water." But if the soil contains a due proportion of gypsum, or when deficient in this respect, if it should be supplied from time to time with gypsum, "the carbonate of ammonia, contained in rain water," (and of course that which is carried down into the soil by rains, falling on putrescent manures) "is decomposed by gypsum, in precisely the same manner as in the manufacture of sal-ammoniac. Soluble sulphate of ammonia and carbonate of lime are formed; and this salt of ammonia, possessing no volatility, is consequently retained in the soil. All the gypsum gradually disappears, but its action upon the carbonate of ammonia continues as long as a trace of it exists."‡ It will be observed from the reasoning of Liebig, that the ammonia which the soil receives during the decomposition of long manure, which may be left or spread on the ground, is also liable to sustain a loss by combining with water and passing off in the form of vapor. But as in this case, the process of fermentation is very slow, the carbonate of ammonia will have more time to combine with the soil, and the roots of plants are constantly engaged in absorbing it. During slow fermentation there is probably but little loss of carbonate of ammonia, even when gypsum is not present, and when present none at all.

So far, therefore, as the products of the soil, which are not useful for the consumption of man or beast, can be left on the ground, that will be the most economical application of manure. In this mode of applying it, the labor of transporting and distributing it will be saved, and much less loss will be sustained by evaporation than where the decomposition is rapid, and no gypsum used. Thus it will be advantageous to leave upon the ground as much of the stubble of wheat, rye, &c., as can be left consistently with an economical saving of the grain. With the same view corn stalks may be left on the ground and ploughed in. The straw of rye and oats, fed off to stock, and of the second crop of clover when fully ripe, will also be of great advantage to the soil. All these will undergo slow fermentation, and if not suffered to be washed away by heavy rains from rolling lands, will add much carbonate of ammonia and some potash to the soil. Liebig informs us, that "ammonia, evolved from manure, is imbibed by the soil, either in solution in water, or in the gaseous form, and plants thus receive a *larger supply of nitrogen* than is afforded them by the atmosphere."* Indian corn, as well as rye and oats, is sometimes fed off by turning stock in the field. In this mode of feeding the whole product of the soil is restored, and the land must necessarily be enriched, in proportion to the quantity of nourishing ingredients, which the growing crop received from the atmosphere, (always a large proportion,) with such abatement only as will be equal to the loss of ammonia, sustained by evaporation.

In the remarks I have hitherto made on manures, I have not referred to one species, which Liebig considers of very great value, I allude to human excrements. This subject is treated very much at large, in the work to which I have so often referred, but it would extend this essay to too great a length to go fully into an examination of this very important ingredient. A few extracts will be sufficient to show its importance. At p. 242 he remarks, "that if we admit that the liquid and solid excrements of man, amount on an average to 1½ lbs. daily, (5·4 lb. urine and ¼ lb. fæces,) and that both taken together contain 3 per cent. of nitrogen, then in one year they will amount to 547 lbs. which contain 16.41 lbs. of nitrogen, a quantity sufficient to yield the nitrogen of 800 lbs. of wheat, rye, oats, or of 900 lbs. of barley."

"This (he observes) is much more than is necessary to add to an acre of land, in order to obtain with the assistance of nitrogen absorbed from the atmosphere, the richest possible crop every year. Every town and farm might thus supply itself with the manure, which besides containing the most nitrogen, contains also the most *phosphates*; and if an alternation of crops were adopted, they would be most abundant. By using at the same time, bones and the lixiviated ashes of wood, the excrements of animals might

* Liebig's Organic Chemistry, p. 130. † Ib. 191. ‡ Ib. 141, 142.

* Liebig's Organic Chemistry, 141.

be completely dispensed with." At page 246 he says "that with every pound of urine a pound of wheat might be produced."

At page 241-2 he states that liquid animal excrements, such as the urine with which the solid excrements are impregnated, contain the greatest part of their ammonia in the state of salts, in a form, therefore, in which it has completely lost its volatility; when presented in this condition, not the smallest portion of ammonia is lost to plants, it is all dissolved by water and imbibed by their roots."

I will quote but one more passage which goes to show the great superiority of human manure over that of other animals. "In respect to the quantity of nitrogen contained in excrements, 100 parts of the urine of a healthy man are equal to 1300 parts of the fresh dung of a horse, according to the analysis of *Macaire* and *Marcet*, and to 600 parts of those of a cow."

Ashes of wood and vegetable substances from which potash is derived, is also a very important manure. "Most plants, perhaps all of them contain organic acids of very different composition and properties, all of which are in combination with bases, such as potash, soda, lime or magnesia."* Without alkaline bases, Liebig says, "most plants could not exist." And it is a remarkable fact that where there is a want of the usual alkaline base in a soil, suitable to a particular plant, another alkaline base will be substituted.† This fact shows the indispensable necessity of an alkaline base in all plants. If further proof were wanting the fact that all trees and plants contain more or less of the alkaline bases would be perfectly satisfactory. Some trees require much less alkali than others. Thus pines and fir trees require a much smaller quantity of the alkaline bases than other species. And consequently the former thrive well on a soil where the latter could not exist.‡ One hundred parts of wheat straw yield 15.5 parts of ashes; the same quantity of the dry stalks of barley 8.54 parts; and of oats straw only 4.42. The ashes of all these are of the same composition."§ The facts here stated, prove that wheat is much more exhausting of this particular manure than barley or oats.

Of such great value are ashes esteemed in Germany, that they are transported, as Liebig informs us, "from the distance of 18 or 24 miles." They are particularly valuable to meadows, as these are constantly drained of their potash by the annual removal of the crops of hay—a crop containing a large portion of that ingredient.

It is obvious that if a soil contain only a limited quantity of potash, it must in time be entirely exhausted, if the growing crops are annually removed, and no part of the product is restored, unless a supply is derived from some other source.

The atmosphere furnishes a small quantity, but by no means sufficient to replenish the waste occasioned by the growing crops, and hence the necessity of making up the deficiency by the application of ashes and other manures, containing potash.

Liebig relates an extraordinary instance of the effects of depriving a soil of its potash, which occurred in the vicinity of Göttingen. A proprietor of land, "in order to obtain potash, planted his whole land with wormwood, the ashes of which are well known to contain a large portion of the carbonate of that alkali. The consequence was that he rendered his land quite incapable of bearing grain for many years, in consequence of having entirely deprived the soil of its potash."*

Liebig says, "it is the greatest possible mistake to suppose that the temporary diminution of fertility in soil is owing to the loss of humus; it is the mere consequence of the exhaustion of the alkalies."† He states a variety of facts to corroborate this opinion. When we reflect that the principal ingredient, furnished by humus to the growing plants, is carbon in the form of carbonic acid, and that plants derive a very abundant supply of this element, *after* the formation of their leaves from the atmosphere, by means of their absorbing power, we cannot but regard the opinion that the diminution of fertility in soils is more owing to the loss of alkalies than humus, as at least very plausible. Liebig is of opinion that the great diminution in the fertility of the soil in Virginia, since its first settlement, is owing to the exhaustion of its alkalies. He estimates that "from every acre of this land, there were removed in the space of one hundred years 1200 lbs. of alkalies in leaves, grain and straw; it became unfruitful therefore because it was deprived of every particle of alkali which had been reduced to a soluble state; and because that which was rendered soluble again in the space of one year, was not sufficient to satisfy the demands of the plants."†

Silicate of potash is an ingredient of indispensable necessity to the vigorous growth of the small grains, and of all plants of the grass kind. Ashes is the source whence it is derived, and hence the importance of saving and applying this manure to our cultivated land, and particularly to that which is appropriated to meadows and raising of wheat. Ashes which have not been lixiviated are of the greatest value, as a manure, but after having undergone that process, they still contain silicate of potash, and salts of phosphoric acid, and consequently are of great importance as a succor to all plants of the grass kind.‡

Phosphoric acid is also a very important ingredient, particularly for the small grains. It is found in the ashes of all plants, "and always in combination with alkalies and alkaline earths." "The seeds of corn (wheat) could not be formed without the phosphate of magnesia, which is one of their invariable constituents."§

I cannot quit this subject without recommending to every agriculturist, a diligent study of Liebig's very able work an agricultural chemistry, and particularly that part of it which treats of manures, and the means of preserving the fertility of soils.

Although the manuring of lands, if proper care be taken in collecting, preserving and distributing them, will do much towards preserving their fertility, and renovating such as have been deteriorated by bad husbandry, yet other means can be resorted to, with great advantage in has-

* Liebig's Organic Chemistry, 148. † Ib. 149. ‡ Ib. 198. § Ib. 199.

* Liebig's Organic Chemistry, 161. † Ib. 196. ‡ Ib. 228. § Ib. 200, 201.

tening the process. A judicious system of grassing our lands which can be accomplished with but little labor, will always be found very useful, and must enter largely into our system of agriculture.

Red clover, there can be no doubt, is the best adapted to this purpose. In consequence of its thick growth, and its numerous and broad leaves, it is well suited to draw nourishment from the atmosphere; and does so, perhaps, in a greater degree than any other grass, except other species of the trifolium. Red clover is one of the tribe of leguminous plants, which "are remarkable on account of the small quantity of alkalies or salts in general, which they contain."* The *medicago sativa* (lucerne) according to Liebig contains less than one per cent. (0.83) and red clover probably does not contain more. Hence one great advantage in the cultivation of this crop will be that it requires to sustain its growth but a very small portion of alkali, while it will absorb from the atmosphere not only that ingredient, but also nitrogen in the form of ammonia, and will thus add to the soil two very important ingredients that enter into the constituents of the food of plants. When we take into consideration, that nitrogen and the alkalies are indispensably necessary to the growth of plants, and that these substances are very sparingly supplied from the atmosphere, we will perceive the great importance of the clover crop in restoring and preserving the fertility of soils. Besides, this crop will furnish fine pasturage in the early part of the year, when other grasses are too short for that purpose. After being fed off by stock, whose manure is left on the ground, it produces a luxuriant second crop, which may either be fed off in the fall, or left as a coat of manure upon the ground. This may be repeated two or three years in succession, as circumstances may require. The last crop, when fully ripe, should be ploughed under in the fall of the year, and will thus furnish a coat of manure for the succeeding crop. If ploughed under when green, the operation will necessarily have to take place during warm weather, and consequently a rapid decomposition and escape of ammonia would ensue. This should always be avoided.

Blue grass is also valuable in restoring the fertility of land, but the process is more slow, and should only be resorted to in lands intended for cultivation, where they can be conveniently left in grass some eight or ten years.

Rye is a crop that exhausts but moderately when the grain is reaped; and when fed off by stock upon the ground on which it grew, is a rapid restorer of soil which has not been much exhausted. It is attended with the advantage of producing two crops from a single sowing, the second always springing from the seed left on the ground by the grazing stock.

The liberal cultivation of grasses and rye—to be fed off by stock—coupled with a judicious rotation of crops, will undoubtedly have a powerful effect in restoring the partially exhausted lands of Kentucky, but a judicious system of manuring, as recommended in this essay, would greatly add to the rapidity of the process, and should by no means be neglected, especially when lands have been considerably deteriorated by bad husbandry.

Little need be said to show the necessity of good tillage in any tolerable system of agriculture. If land be carelessly cultivated, weeds not only draw from the growing crops a portion of the nourishment, which ought to have gone to their sustenance, but they also tend to diminish its fertility. Besides, air is essentially necessary to the growth of plants, so much so that Liebig informs us that "without oxygen, neither seeds nor roots can be developed." If the soil be kept light, and finely pulverized, it greatly increases its capacity for absorbing air and moisture. And as "plants during their life constantly possess the power of absorbing by their roots, moisture, and along with it, air and carbonic acid,"* it follows, that "by loosening the soil which surrounds young plants, we favor the access of air, and the formation of carbonic acid; and on the other hand, the quantity of their food is diminished by every difficulty which opposes the renewal of air."†

Thus, by a careful and diligent cultivation of land, the crop is furnished more abundantly with its appropriate food, is kept free from the contaminating influence of weeds, is furnished with a due quantity of air, and is not obstructed in its growth by the baked earth with which careless cultivation leaves it hampered. And in addition to the advantages resulting to land, the diligent husbandman is rewarded with a greatly increased crop, and the prospect of being relieved from much labor in future, by exterminating all noxious weeds from his arable grounds.

Liebig affirms that "the agriculture of China is the most perfect in the world," and *there no weeds are suffered to grow.*

If, by any, it should be thought I have been too minute in describing the elementary principles constituting the food of plants, I rest my justification in the opinion expressed by Liebig, that "any great improvement in that most important of all arts (agriculture) is inconceivable without a deeper and more perfect acquaintance with the substances which nourish plants, and with the sources, whence they are derived."‡

The judgment of Liebig will doubtless be a sufficient apology, unless we are content to be still subject to the reproach that "agriculture has hitherto never sought aid from chemical principles, based on the knowledge of those substances which plants extract from the soil on which they grow, and of those restored to the soil by means of manure."§

A. BEATTY.

* Liebig's Organic Chemistry, 204.

BERKSHIRE HOGS.

From the Farmers' Cabinet.

An article in the last Cabinet, under the caption of Berkshires, and containing so very unfair a judgment on the merits of that invaluable breed, over the signature of R. S. B., Northampton county, together with the severe strictures of G. H. D., where the Berkshire mania, so called, is classed with the humbugs of the day, seem to make it proper for their friends, if they have any

* Liebig's Organic Chemistry, 83. † Ib. 106. ‡ Ib. 62. § Ib. 207-8.

left, to protest against their being thus unceremoniously killed off without benefit of clergy. Indeed, at this time, when, with the versatility peculiar to American character, the agricultural press is teeming with anti-Berkshire essays, condemning, in louder tones than ever were uttered in its favor, the whole breed, as a Merino sheep, multicaulis humbug, it might seem almost presumptuous, even in one who has tried them, to endeavor to stem the torrent. It seems unfortunate that, on the introduction of any thing new, either in agriculture, science, or the arts, in the thermometer of public opinion, the mercury, starting at zero, must rush up immediately and rapidly throughout its whole range, and all the way back to the starting point, and even below it before it finally attains its proper state of quiescence. Particularly on the introduction of a new breed of animals, we seize on them with great avidity from the mere novelty, invest them with extravagant and supernatural qualities, proclaim the wonderful things they *are to do*, and when at last they fall short of these calculations, the whole affair is pronounced a "Merino, multicaulis humbug." From being placed in the first instance far above their merits, they are next placed far below them. This, in the United States, is always the modus operandi of introducing new breeds of stock to farmers, who, after passing through the high fever stage of heavy profits, and down again to the cold or collapse, at last finally settle in a medium temperature, and give to the new breed whatever is its just value. To this process Berkshires must submit. R. S. B., in the communication referred to, does not make the true issue. He says one of his neighbors put up two Berkshires and two common hogs in a *stable* to feed, and that the common ones outweighed the others. This is very probable, but does not prove the main point, *that the Berkshires did not return the greatest weight for the quantity of food consumed.* Berkshire breeders do not contend that *generally* they attain such great weights as other hogs, but that a given amount of food will make a greater quantity of pork; that if it does not feed such large hogs, it will feed a greater number. I have so fully satisfied myself of this point, that, although owning some very fine ones of the Chester county breed, I have killed them off, and intend keeping nothing but the thorough-bred Berkshire. At about 12 months old they will weigh from 200 to 260 lbs., being ready for slaughter at any period of their growth, and requiring at last but a few days' feeding upon corn to harden the meat. The shape of the true Berkshire is perfect, forming the beau ideal of a perfect animal; the bone fine, the head and all the offal parts very small, the most valuable parts, the hams and shoulders, full, round and large. Occasionally it is admitted that they have not sufficient depth, but this is only an exception. Where it occurs, the owner must remedy it by careful selection. This cannot be made a valid objection, for there is no breed, however pure and perfect, of any animals, but that something must depend on the judgment and talent of the breeder to keep so, and to remedy any occasional or inherent defect. Something approaching the barrel form must of necessity accompany the quality of easy feeding. In regard to size, the farmers here who feed a few every fall for Philadelphia market, besides what is wanted for home consumption, find that a hog weighing from 150 to 250 lbs. is the most saleable and brings the best price. The Berkshires make just the weight wanted for family use. Whether in Northampton county, where grain is lower than here, they cannot *afford* to waste it on large consumers, which will carry to market greater weight and size, is for him to say. Another characteristic of the Berkshire is the superior quality of the meat. In this at least there is no mistake. Berkshire hams are well known in Philadelphia for their superior flavor and richness. They are remarkably free from fat, and are no less known by their handsome rotund shape, than by their tender and juicy qualities. A slice of Berkshire ham, properly cured, is a dainty morsel appreciated by a connoisseur. Another recommendation is the great fecundity of the breed, producing from 8 to 15 at a litter, and the fact of their being most excellent nurses. By a most unaccountable mistake, R. S. B. objects to them on this very head, and says they are not prolific, that four of his neighbor's sows had but one each, and that generally they have but four or five. I have raised Berkshires for several years, have sold numbers of them, not only in this neighborhood, but to gentlemen at a distance, and as far as my experience and observation go, would say they are not more noted for their *black* color than for their success in safely rearing a full average number.

The true question then at issue, at least in this section of country, is, *what breed of hogs will return the greatest weight for the quantity of food consumed.* Here lies the profit more than in the individual weight. A small, well-made animal may bring more money to the farmer, than one of twice his size, from the difference in the fattening property. It is generally admitted that very large animals are not profitable. They may do to grace the columns of a paper, and gratify those who have a penchant that way, without regard to the expensive process, but they will not suit the common farmer. I once was seized with this desire to feed a large hog; I purchased of a breed well known for attaining immense weights, but was completely cured. It weighed between five and six hundred, and consumed as much food as I am since satisfied would have fattened double the weight of Berkshires. It is a satisfaction to the early friends of the Berkshires, to observe that public opinion in respect to them has passed through the collapse state; that wherever the pure breed exists, prejudices even against color are rapidly dying away; and that they are slowly but surely creeping into favor, and earning the emphatic appellation of the farmer's hog. One thing undoubtedly which has retarded and still retards their reputation is the vast number which, since they were first introduced, have been palmed off as genuine Berkshires, having very little if any of that blood. The cause of this is to be found in the high prices at which they were sold, $30 and $40 per pair, and the absurd rule for testing purity, that they must be precisely of a certain shade of color, having so many white feet, and so many white hairs in the tail; thus inviting imposture, and inducing persons, wherever they could obtain these marks, which often appertain to a half or three-quarter blood, as well as to the full blood, to pass them for genuine Berkshires. A cross

for the purposes of specu'ation has, no doubt often been founded on very inferior stock. The true Berkshires have thus been made to bear not only their own burdens, but have been charged with the sins of a whole herd of worthless mongrels. However breeds may be denoted by certain external marks, either of color or shape, no rule for all cases can be invariably established: there will occasionally be exceptions. Durham cows generally run into light colors, and it is more absurd to say that Berkshire pigs are or are not pure on account of their feet or tail, than to condemn a Durham cow which happened to be of a red color, or had a dark nose. P. M.

East Bradford, Chester Co., Pa.

MURRAIN IN CATTLE.

From the Farmers' Cabinet.

We have sad accounts from England respecting the fatal disease which is carrying off their cattle by hundreds, and think that Mr. A. B. Allen did wisely in abstaining for the present from bringing over any horned cattle. It is said the veterinary surgeons term the disease the bloody murrain, and consider it infectious: now I know not how this can be, for amongst the very many cases that I have witnessed, I have never been able to convince myself of that fact. It is true that to a casual observer it may have the appearance of being so, for the cattle in a large pasture, or even in a whole parish or hundred, will oftentimes be attacked by it, and the disorder will spread abroad like a contagious fever, but I have no doubt the evil arises from a disordered state of the digestive organs, brought on by an unwholesome state of the atmosphere, or by feeding on unhealthy pastures, those low, cold and damp meadows, infested by aquatic plants, which, being taken into the stomach, become putrid and indigestible; and thus that noisome and putrid disease is engendered. For I have known one half the cattle upon a certain farm to be carried off by it, while not a single case has occurred on the immediately adjoining estate, but on the next farm again to that, the whole herd has been swept away; and just so have I observed the produce of their pasture lands to vary from dry, sweet and healthy herbage, to that which is long, moist, sour and unwholesome. And I am inclined to believe that the murrain in cattle, like the botts in horses, may be considered an *effect*, rather than a *cause*, both disorders arising, perhaps, from an unhealthy state of digestion, by which is engendered a disease, which, although it must be termed epidemic, might not be by any means infectious; indeed I well remember a dairy of fine cows which was thinned to less than one-half its original number, where the individuals were attacked by the disease on being confined to their winter quarters, the occupants of stalls 1, 3, 4, 6, 8, 10, &c., being carried off, while the intermediate numbers escaped uninjured, and remained in perfect health.

But to many persons it will no doubt seem strange to consider the origin of two disorders, so very different in their appearance, symptoms and effects, as the botts and murrain, as arising from the same cause, namely, indigestion, but as I conceive that they are engendered by a disordered state of the stomach caused by sour and unwholesome food, and that they might both be cured, or which is better, be *prevented*, by timely administration of a medicine, 'alkaline in its nature, I believe that reason will bear me out in the conclusion to which I am partly led by perusing an article on this subject in the Cabinet, vol. 4, p. 177, where it is said—quoting from the American Farmer—"Some years since I purchased a horse, but he had the appearance of laboring under disease; I commenced a course of treatment which I had before pursued in cases similar to appearance, but without effect; I was therefore induced to try the use of *lime*, as I was confident he was filled with botts, for he had discharged several; I therefore commenced by giving him a table-spoonful of slacked lime three times a week in bran mashes. After pursuing this course near two weeks, the botts began to pass away in quantities, varying from ten to twenty, which he would expel from his intestines during the night; in the mean time his appetite began to improve, and in six weeks he was one of the finest geldings I ever saw; from that day to this I have kept up the use of lime amongst my horses with decided benefit; and as an evidence of its good effects, I have not lost a horse since I began to use it. And lime is a certain preventive in keeping cattle from taking the murrain. As an evidence of this fact, I have used it among my cattle three times a week, mixed with salt, for three or four years, and in that time I have not lost a single animal by this disease; but in the mean time some of my neighbors have lost nearly all the cattle they owned. But I will give a stronger case than even the one above mentioned. One of my neighbors who lost all his cattle, had a friend living within two hundred yards of him, who had several cattle which ran daily with those that died, and his cattle all escaped—he informed me that he made it an invariable rule to give his cattle salt and lime *every morning*. I have, therefore, no doubt but salt and lime are a sure and infallible remedy for botts in horses and murrain in cattle."

And I am reminded of a circumstance by a friend, who has often before mentioned it; he had two fields of pasture near his house—on one of these he spread lime upon the turf to the amount of more than 200 bushels per acre, but as the other field lay immediately below his cattle-yard, from whence he had formed drains to carry the water over its surface in the most complete manner, he determined to let that suffice for a dressing; and the effect of the highly impregnated water from the yard was a growth of grass truly astonishing. Both fields were kept in pasture, and when the stock had eaten one of them down, they were removed to the other, and so changed regularly about; but the effect of the different crops on the appearance of the stock, horses and cattle, is not to be expressed, for while feeding on the limed land their coats were close, shining and healthy, and their spirits light and cheerful, even when they were compelled to labor hard to obtain a bellyful; but when turned into the watered grass, six inches or more in height, a difference for the worse could be perceived in 24 hours, and every day after they lost condition amidst the greatest abundance, with coats rough and staring,

lax in the bowels and flaccid, with distended paunches, dejected countenances, and sluggish in their movements; they soon exhibited a depreciation in value to the amount of about half their former worth. But the transition to health and vigor and good looks was quite as sudden and apparent on a return to the limed land; for again in 24 hours, or by the time the food had passed through the system, a change, particularly in their air and carriage, was very perceptible. My friend adds, he never had an instance of the murrain or botts while his stock fed on these pastures, but is satisfied he should have had both, but for the change to the limed land; for while feeding on the watered pasture, the stock had always the appearance of a predisposition to that state of derangement of the digestive system, by which he has no doubt these diseases are engendered.

In conclusion, I would ask, is it not quite fair to draw the following deduction from what has been said, namely, that all dairy pastures ought to be heavily limed, it being the most natural thing in the world to suppose that a proper secretion of milk, the best and most wholesome, depends very much on the nature of the food with which the animals are fed? and must not the butter from a cow that is in health and spirits be of better flavor, color and consistence, than that from one that is lax, washy and weak, from feeding on watery, acid and soft herbage? and will not this account for much of the disgustingly rancid, ill-flavored and ill-looking butter which we so often find in the market? My friend above quoted, and who is now at my elbow, answers "Yes; for while my cows fed on the watered meadow, the butter was scarcely eatable—white, soft and ill-flavored, but it was sweet, firm and fine-flavored when they were confined to the limed land." Ergo, lime your pastures, and allow your stock as much salt as they will consume daily, for I am convinced that lime and salt are a remedy for "botts in horses," as well as the "murrain in cattle." VIR.

REMARKS UPON ENGLISH CATTLE, AND A COMPARISON OF THEM WITH AMERICAN.

From the Kentucky Farmer.

It has become a matter of great importance to the American stock-breeders, to know now whether they can make any further improvements in their domestic animals, and if so, how, when and where. It would require too long an essay to be read before this society, to attempt to go over the whole circle of British domestic animals. I shall, therefore, in this paper, after an incidental paragraph, confine my remarks to neat stock alone, which at present probably most interests Kentucky.

I was not only at the annual meeting of the Royal Agricultural Society, but present also at that of Yorkshire, which was much superior in its show over the former, in horses, short horns, long wool sheep, and swine. I also privately examined the stock of many of the most distinguished breeders in Great Britain, and am free to declare, that, a few South Devon sheep excepted, we want scarce any thing more from abroad for years. Our roadsters and horses of all work, are superior to those of England, in shape, action and endurance—our cattle nearly as good. With fine wool sheep she has nothing to compare with us, and our splendid herds of swine, improved by the late importations, are now made quite equal to any.

Short-horns.—Just before leaving for England last spring, I took a careful survey of Ohio and New York, and since my return have gone again over much of the same ground, together with the addition of a part of Kentucky; and this second look has only the more fully confirmed me in the judgment that I formed while abroad, that, the *best* of one breeder's herd alone excepted, the short-horns of America, are quite equal to those of Great Britain. I therefore do hope, till the choicest of these can be had at a reasonable rate, that our money may not be wasted abroad in the pride of further importations—more especially during these hard times, and under the consideration of the little that Europe is taking of our agricultural products in return. Short-horns bred here can now be purchased throughout the country, of as good a quality as abroad, for half the money that it would cost to get them from there. Let us appreciate then what we already possess, foster, cultivate and spread it—*free ourselves from the* THRALDOM of foreign opinions, and no longer be carried away by the fashion of the word—"*imported.*"

I found English breeders very slow to believe that their stock, brought over here, were made *better*, rather than *deteriorated* in the change. Such a thing they thought utterly impossible in poor ignorant America. But that a great and decided improvement has been made in it, when fallen into any thing like judicious hands, can be demonstrated even to the most purblind and prejudiced. Animals may be seen now coarse and somewhat lathy, imported a few years ago, the third descendants of which are fine, compact, and symmetrical; and others that, in England, were somewhat wanting in constitution, have here completely renovated themselves, and become strong and hardy. If asked to account for these things taking place, I should answer mainly, that our climate especially in the southwest, was better adapted than that of England for the production of neat stock; that our grasses were equally abundant and less watery, and consequently more nutritious; and that our breeders have *some little skill, judgment and taste* in these matters, as well as those abroad.

Herefords.—Though a large and rather a fine, noble looking animal, the Herefords, in comparison with the short-horns are coarse and heavy in the head and horn, with a gathering of thick flabby skin under the jowls, and considerable dewlap. Their loin is well spread, but from the hip bones to the rump they drop suddenly away, and point out like the small of an egg, they also thin off in the flank, and are not usually as well let down in the twist as could be wished. They do not mature as early as the short-horns, and disinterested men were uniform in declaring to me that it took a stronger soil and better grass to support them. This has been denied by the Hereford breeders, but I found the advocates of short-horns very desirous to make the trial by feeding them side by side, to see which should

give the most and best beef on an equal quantity of food.

The quality of the Hereford meat is claimed to be superior—this I doubt, compared to the best short-horns. They are not dairy stock—in what then consists their merits? It is answered the yoke, they make powerful working oxen. But do we want workers alone? and if we did, are we deficient in them? Let the clean-limbed, powerful, muscular, quick-stepping cattle on the hills of the north, the east, and west, answer these questions. And as to their color, I often see those of a beautiful red, with line backs and white faces and belly, in my various perambulations through the states, and have no doubt but they are the direct descendants of as good Herefords as ever graced old England, and long since imported into this country.

But all Herefords abroad are not red, with white faces, &c. Some of the choicest and best that I saw exhibited at the Royal Agricultural Show, and elsewhere, were pure white; others again light roan, with red-tipped ears. I eagerly asked from whence these colors came, as the Herefords are a cognate family of the Devons, which are a deep mahogany red. No satisfactory reply was ever given me. Can I be wrong then in inferring that it was from a short-horn cross, especially as I found the form of these lighter colored animals more nearly approaching that breed than Herefords usually do? If I am correct then in these surmises, where is the necessity of further importations? We can take short-horn crosses on the beautiful brockle face animals that we already possess in our country.

Devons.—The red cattle of the eastern states doubtless originated from the North Devons; and if as much pains had been taken in breeding them in America as in England, they would probably be now as beautiful and perfect. A few very fine late importations have been made of these animals, probably quite enough to satisfy the demand at present. I think them better adapted to the light dry soils of our country than any other breed, the Scotch highland cattle alone excepted.

The South Devons of the same deep mahogany color, I found much larger than those of the north, almost equal in size to the Herefords, and some of them with nearly the fine handling, the loin and quarter of the short-horn. The cows of this breed are not unfrequently very good milkers, giving not only a large quantity, but also that of a rich quality. The oxen are admirable in the yoke, and make excellent beef. To those who have good pastures, and like this style of animal, and cannot rest satisfied with a cross of the short-horns or the Devons already in the country, I would recommend a small importation. I subjoin the size of a bull 3 years and 4 months old, that I inspected among others. Height over the shoulders, 4 feet 10 inches; girth round the heart, 7 feet 9 inches; length from base of horn to end of rump 7 feet, 5 inches. I think he might have been fatted to weigh 13 or 1400 lbs. dead weight. A cow 7 years old, of the same breed, was but a trifle inferior in size.

Sussex.—It is contended by many, that it was from the Sussex cattle that the Devons and Herefords sprung, the former therefore and not the latter, as has been generally asserted, were the pure originals. Be this as it may, their color and general characteristics are much like the Devons, and their weight but a trifle inferior to Herefords, with rather a greater proportionable length of body. The finest specimens are very symmetrical in shape, with limbs clean and sinewy as those of a race horse. I am confident that this style of cattle would rather suit the taste of the south. They are only moderate milkers, but their beef is pronounced unexceptionable, as indeed will that of all well shaped animals be found, when properly fatted, and that are worked in the yoke somewhat, and do not mature till about 7 years old.

It was against this beautiful race, the herd of Mr. Selmes, that Earl Spencer showed his splendid drove of short-horns for a mere nominal wager. Of course the Earl won, but not quite so easily as was anticipated. These animals are attracting considerable notice just at present in England among the graziers.

Jerseys.—The cows of this breed have been much celebrated for the quantity and quality of their milk. No doubt much improvement has been made in them by careful selections, with reference to these particular properties, still a great deal is owing to their high feed on parsnips, a root cultivated in great quantities and perfection in the Isle of Jersey, but after considerable inquiry, I could not find that they excelled the average of our own good native stock in these particulars, when equally well fed. They are of medium size, with short, fine, clear, waxy turned up horns, long clean head, beautiful mild eyes, thin neck, fine limbs and shoulders; but their backs are sharp, and they carry a very light quarter, and bred in so mild and equable a climate, their constitution is delicate, and with so thin a skin, as to make them totally inappropriate to our climate, when the flies of summer would so torment them on the one hand; and the cold of winter pinch them on the other.

Ayrshires.—This is an inferior short-horn in miniature, and I candidly think has been greatly overrated. That it is an excellent cow both for the dairyman and butcher, in the particular district of Scotland that it inhabits, and fed upon their peculiar food, I do not doubt, but when they come to be transported to England, and especially to America, they have not fulfilled expectation in these points. They derived their principal good qualities from a cross of the short-horn bull, these animals we have now among us at a moderate price, and in great perfection, to those therefore, who wish for something like an Ayrshire, already acclimated to our hands, I recommend to save their money at home, and purchase snug short-horn bulls of a medium size, bred here from milking families, and then cross them upon the best native milkers at their hand, from these make the most approved selections, and so continue on, and in this way with a small comparative outlay, a superior race of animals may be grown up throughout our country, better adapted to our use, than any thing we can possibly import. Grade short-horns are abundant now, especially in the west, superior in form for the butcher and milking qualities, to any Ayrshires that it was my good fortune to meet with while abroad.

Red Galloway.—By the above I mean a deep formed, square, bright red cow, without horns, and of these I have seen as fine specimens on the

Jersey marshes opposite the city of New York, said to have been originally imported from Holland, as I believe exist in the world. They were kept there as dairy cows, for the purpose of supplying that city with milk, and had the size and nearly the perfection of form of a snug short-horn, were capital meat well fatted, and rather celebrated as deep milkers. This breed I look upon as particularly desirable, they never can injure any thing by goring with the horn, and wanting these excrescences, it takes away of course just so much offal, and, as I think, adds so much the more to their value.

Black Galloways.—These are essentially the same as the reds above described, existing in the Galloways and other districts of Scotland, and the North of England, but perhaps, as a grazing beast of a higher repute, and are brought up and fed in large numbers from Scotland throughout England. I should like to see an importation in a small way into America of this useful race of animals, for they are active, lively, kind, and quiet in disposition, and superadded to their good qualities of meat, are fair milkers. I have heard them called Highland, and black cattle, simply, as well as Kyloes, Aberdeens, Angus, Keillor, Humlies, &c. There is also another kind of black cattle with horns, that are something of the same quality as the Galloways of the high bleak hills of Scotland. The above are all that struck me as peculiarly valuable in British cattle, and in summing up, it will be seen that we already bountifully possess the elements of good husbandry. We now want to be better informed, what animals best suit the soil, food, and climate of particular sections of our wide extended country, and it is to this point that I would earnestly solicit the attention of breeders in their communications, when treating hereafter on this very important and interesting subject.

A. B. Allen.

To the Pres. Ky. State Ag. Soc.

From the Southern Agriculturist.

MANURING WITH SALT MARSH GRASS AND MUD, ON THE SEA ISLANDS OF SOUTH CAROLINA.

(Extract from a Report on Sea-Island Cotton.)

No portion of the state is so abundantly supplied with materials for enriching the land as the Sea-Islands. On many of them there is scarcely a plantation of which one or more creeks do not form part of its boundary. The quantity of salt grass, and of mud is therefore inexhaustible. If these were skilfully used, the complaint of failure in the crop, from sterility of the soil, would seldom be heard. Of the former, marsh is not only in every respect superior to the rush, (one of the varieties of the plant of the genus juncus,) but stands pre-eminent as a manure for cotton among vegetable substances. To realize its full value, it should be incorporated with the earth during the summer months—the earlier the better. After the working of the crop has been completed, a certain number of active men are set to work with suitable flats or boats. The cuttings of each day are taken to the field on the following day and immediately buried; or rather a little earth from the tops of the ridges are thrown upon the marsh, which, as the chops with the hoe are not made continuously along the entire line of the ridge, but intervals of six or eight inches of sward are left, is by this process only partially covered. The quantity for an acre is twenty piled cart-loads. If the land be very light, only sixteen loads are recommended, as the blue disease, where it is not sparingly used on such grounds, is likely to be generated, of an irregular season.

Of course on all soils favorable to the production of blue cotton, the application of marsh should be carefully avoided. By the rotting of this grass from exposure to the rains and heat of summer, according to the mode of piling it for future use so generally resorted to, one-third of its nutritious properties is lost by evaporation, and consequently, one-third of the labor and time expended in collecting it—a point which appears to be wholly disregarded by the planter—is uselessly expended. If twenty cart-loads, the amount in general necessary for one acre, be accurately ascertained but not then listed in, when the usual period for removing them arrives, it will be found, that about twelve loads constitute the entire bulk; further, that the growth of the crop will show, that the manure is comparatively of an inferior quality. The task in gathering marsh for each laborer per day is three piled cart-loads. With these data, let us compare the actual results of the two practices, of which winter listings is almost universal. Ten fellows in thirty days will cut but nine hundred loads, which, if buried in summer, will cover forty-five acres of ground. On the other hand, if the operation be postponed until February, the quantity will be reduced to about six hundred loads, or enough only for thirty acres: the gain therefore by the method recommended is equal to the labor of ten men for ten days. Added to this there are incidental advantages worthy of especial notice. At no period is less work done by negroes than during the season for gathering manures. All expedients hitherto adopted to secure a full day's labor have been easily defeated. This plan surmounts the difficulty, as far as responsibility and mutual checks can accomplish it. Every day three sets of workers are separately engaged in effecting a particular purpose—the burying of a certain amount of marsh in a given quantity of land. The listers look to the carters, and the latter to the cutters. By these means, unless the head cartman, who should be selected for his faithfulness, neglects his duty, one and a half acres daily are well manured. Supposing four carts to be steadily engaged in taking away the marsh, and four ordinary females in listing it, the expense of fertilizing the six tasks, or one and a half acres, will be the labor of eighteen hands, of whom three may be small boys, and four mules per day.

The objections to summer listings are, first, that they expose the ground to the action of the sun when its surface should be protected by shade; secondly, that they injure the pasturage; and thirdly, that on very light soils and low lands, where marsh is applied, certain diseases known by the appellations of "blue" and "flaggy" are liable to be produced. In reference to the first objection, it may be remarked, that the tops of the old beds, from the want of moisture, are usually bare. If the mode of taking from those parts of them only a small stock of earth in the manner already explained, be rigidly adhered to,

the injury from this source, if any so decidedly manifest is the benefit of the general practice, is too inconsiderable to be noticed. But it is denied that any pernicious consequences whatever ensue. If there exist for a brief season a partial denudation of a very small portion of the soil, the deposition of a large body of rich vegetable matter under its surface will soon start into existence, if the season be moist, a crop of grass, where the sheep at some period of the day may always be found. The pasture grounds are consequently improved, at least under the influence of marsh, where the proper precautions are regarded.

Whilst it is believed, that no adverse or irregular season has ever been known to produce blue cotton on lands assisted by rotted marsh listed in the winter, if this grass, where an undue quantity is used, be allowed to decompose under the sward by being buried in summer, that disease, in certain locations and under particular circumstances, educed by the weather, will occasionally show itself. The manure in the former state, having parted with most of its exciting properties, is at no time capable of exerting much power; but in reference to the latter, the excess of stimulus from a rapid fermentation during the season of the greatest heat and moisture, increased in proportion to the porosity and friability of the soil, deranges the functions of the plants, and ultimately perhaps destroys their procreative powers. This is the true reason why the lighter the land the greater the probability of danger from the application of marsh in summer. The remedy is obvious. On such soils use this substance more frugally, or with salt-mud, the great antidote to the "blue" poison. In addition to these suggestions, as alike applicable to low grounds, a resort to the spade is an essential auxiliary in preserving the health and arresting the flaggy disposition of the cotton plant.

All that has been advanced on the subject of putting marsh under the ground in summer, applies with greater force to the rush-grass. Its decomposition is slow, and as it contains less aliment than its co-assistant, from seven to eight cart-loads to the task are required. It is a very safe manure, and well suited to any soil. Pine straw is of little value except when well trampled by the cattle. In its crude state it should be put only on the highest and driest lands, as it ministers to the growing crop mainly by collecting and retaining moisture. In aid of this purpose, and to destroy the vermin of which pine-straw is the fruitful parent, the use of salt, at the rate of from one pint to a quart to the task row, will be found eminently beneficial.

Of salt-clay-mud it is not our design to speak at large. Although the best quality—that which has the largest proportion of marsh-roots, contains all the necessary ingredients of the most perfect soil, yet it is true that it gives but an inconsiderable growth to cotton. May not this arise from some circumstance connected with its application to the land? The usual practice is to gather it between hoeing and harvest for future removal, or, if then taken to the field, to allow it to lie there until January or February. In the latter event, the heaps themselves soon exhibit the highest evidence of having incurred a considerable loss, but for this, compensation is erroneously supposed to be made by the facility with which the parts are separated, caused by the exposure of the mud to atmospheric action. When thrown up in winter, it is immediately put in the ground. All its virtues are thereby retained; nevertheless, if the lumps be not thoroughly broken a large quantity of mud will yield but a small quantity of manure. *Ten cart loads well pulverized are of more benefit, than fifteen loads carelessly chopped.* If the mud as soon as collected in summer be taken at once to the field, and there undergo the admitted tedious process of disintegration with the hoe, the chief benefits of the two plans might in a great degree be experienced. The labor of carting and of chopping, if at all, would only be slightly increased, as by this practice a much less quantity is necessary. In any field, which two years before had been in cotton, the lumps of mud will be found in the same state in which they had been put in the ground. The vegetable matter therefore which composed them, it is evident, did not exercise its full power, though to effect that was the design of the planter. How then was the crop assisted? Only by the saline and alkaline properties of the mud, and the small stock of nutriment given merely by the surface of the lumps. If to these benefits, the clay, an essential part of this substance, be made to mix with the soil, which can only be done by pulverization, and the marsh-roots, that ought to constitute one-half of every hoeful, be detached from the mass and cut into particles in order to facilitate their solubility, then, it may be said, that, as a manure for cotton, salt-clay-mud, in a series of years, will realize a greater profit than any other known substance. The neglect of these apparently trifling matters, is probably the reason, why this manure does not materially add to the growth of cotton. As it is of a cold nature, it is never advisable, except where the strength and natural warmth of the land will justify it, to use it alone. In connexion with cotton seed, at the rate of only two and a half bushels to the task, or of well rotted compost manure, one piled basket to the row, its benefit is perhaps duplicated.

EXTRACTS FROM THE SIXTH AGRICULTURAL MEETING AT THE STATE HOUSE.

From the New England Farmer.

Subject, Sheep husbandry. Mr. Fitch, of Sheffield, replied, that if the object is to get *wool*, the Merinos and Saxonies are best; but if *mutton* is wanted, the large, long-woolled are to be chosen. The Saxony is from the Merino. The object aimed at in Saxony was *fineness* of fleece. At present prices, the Merino is more profitable than the Saxony, taking weight of fleece and constitution both into the account. They produce *almost* twice as much. Saxonies will give a fleece of 2 1-4 lbs. which will bring 50 cents. A flock of 40 Merinos, in Connecticut, with which he is acquainted, gave 200 lbs. of wool, or 5 lbs. each, worth from 38 to 40 cents;—the same flock gave 40 lambs. The sheep have every attention and are well kept. Has himself taken 16 lbs. of wool from two Merino bucks. The Merino is more hardy than the Saxony—bears the winter better and requires less attention at the time of lambing. At birth the Merino lambs are clothed—while the

Saxony are almost naked. Fineness of wool is generally an indication of degeneracy—and fineness of hair on the human head indicates the same.

The fineness of Saxony wool has been produced by breeding in-and-in. This course brings degeneracy. These sheep require a close house and much care. The Merino will do well with much less attention. Thinks sheep manure good; and when properly littered they will make more from a given quantity of food than cattle. They improve fields more when feeding upon them.

Mr. Tidd, of New Braintree, asked whether Mr. Fitch had been speaking of *pure* Merinos.

Mr. Fitch. Yes. The Merino will give as much wool as *any other* sheep of the same weight. The expense of keeping is in proportion to *size* the *wool* is in proportion to surface. The solid contents of cylinders are as the cubes of their diameters: the surface is as the squares. So that if the sheep are of equal length and round, the smaller one will have the most surface in proportion to weight. [Let the diameter of one sheep be 2, and of another 3. The square of 2 is 4; its cube is 8. The square of 3 is 9—its cube is 27. The surfaces in these cases are as 4 to 9—while the bulk, weight, or solid contents is as 8 to 27,—showing that there is obviously good ground for Mr. F.'s conclusion, that a larger amount of sheep surface or wool ground can be maintained at the same expense on small sheep than on large ones.—*Reporter.*]

Wool on large sheep is generally looser than on small ones. The small have the most wool in proportion to size. Merino and native cross give good stock of fine constitution—better than Merino and Saxony cross.

Mr. Plunkett, of Pittsfield, said his experience is not much, but he thinks that sheep should be suited to the soil. Small ones are best for hills and short pastures, larger ones for rich pastures and meadows. He can make about as many pounds of fine wool as of coarse on the same quantity of feed. The raising of sheep has not been a very good business lately, owing to the low price of wool—but perhaps it has been as good as most other branches of farming. A cause of the low prices and of need of better protection, may be found in the following statistics.

The growth of wool in the United States is probably not less than forty millions of pounds. It may be assumed that one half of this amount is worked up in our manufacturing establishments.

The importance of this branch of agricultural industry is not only great considered of itself, but in its effect on the other branches of agricultural labor. If the farmers are driven from the wool growing business by low prices of wool, then the dairy and beef growing business will become depressed from over production of those great staples.

It is well known to the farming interest that at the present time the price of wool is very much depressed, and that our wool growers are generally desirous of getting out of that kind of farming; and it might be useful to inquire into all the causes that have tended to this depression.

By the compromise of the tariff question in 1832, all foreign wool costing at the place from whence imported less than eight cents per pound, was admitted free of duty. There was imported in the year ending Sept. 1832, 4,042,838 lbs.; out of this amount were exported 1,227, 959 lbs.; leaving less than three millions of lbs. to be consumed in this country.

The importation of wool has gradually increased since that time. In the year ending Sept. 30th, 1838, there was imported 6,968,365 lbs.; 6,551,128 of which were imported free of duty. In the year ending Sept. 30th, 1839, there was imported 7,824,548 lbs.; 7,398,519 of which were imported free of duty. Only 9,800 lbs. were exported during the same year. Mr. P. has not been able to ascertain the importation of wool in the years of 1840 and '41. We may, however, from known facts about the importation of wool, calculate the amount imported in the last year to exceed ten millions pounds; an amount equal to about one half of what is raised by our farmers in this country to be sold to the manufacturers.

Here we have a principal cause of the great depression of the price of wool at this time.

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Mr. Cole, Editor of the Farmer's Journal, has had experience with but few kinds; first had natives—next 7-8 Saxony. This flock gave fleeces of from 4 to 6 lbs. The Saxony, where he lived in Maine, was preferred to any other. The reports of the Agricultural Society of Kennebec county, Me., show that they prefer the South Downs to any others. Pastures for sheep should be high and dry. They do best in dry seasons. He has never seen them drink in summer. In winter they will drink oftener than cattle. Clover hay is good feed for them. Roots are excellent for them in winter, but they should not have many potatoes just before lambing; better then to give some grain. Evergreen boughs are often given and answer a good purpose in feeding. The manure is better than most other kinds. (L. Peters, Esq., of Westboro', inquired what kind of grain he would give.) Does not know whether corn or oats is to be preferred, but would grind in either case.

Mr. Moseley, of Westfield, has found the Johnswort poisonous and troublesome to sheep when he gives them salt, but not so when salt is withheld. Ten sheep, with him, require two tons of hay worth 24 dollars; can get 12 dollars worth of wool and 12 of lambs; and by throwing in the pasturing come out square:—that is the way farmers are getting rich. Their manure is good. * * * * * *

SCRAPS OF FARMERS' CONVERSATION.

Reported by the Editor.

Recently, though at different times, I met and conversed with three farmers, who, in remote situations and under very different circumstances, have made remarkable improvements by enriching land and improved cultivation, and have also reaped large profits from their improvements and farming in general. The subsequent comparing of some of the opinions expressed by these successful improvers, induced the belief that even a very imperfect statement of them, and some of

the particulars of their different practices, would furnish interesting matter for the consideration of others. As there was no intention of this at the times of conversation, and no notes made, it is very likely that mistake or forgetfulness may now cause some errors of statement. If so, I shall be glad to be corrected, and also to be fully informed in writing, for publication, on every part touched on. Should such be the result, even my misstatements by mistake may produce light, and render service heretofore withheld from agriculture. For two of these very intelligent and successful farmers (though long-continued and approving readers of the Farmers' Register) have never contributed, directly, a single line to the pages of this publication; and the third, though he has done much more in that way than most other subscribers, by furnishing several valuable communications, still has *not* communicated near as much of valuable facts ascertained, and observations made, as he might have done, from his abundant resources.

Mr. William Old's farm is in Powhatan, and forms part of a very remarkable strip of peculiar and good soil, which extends not only through that county, but also Nottoway and Goochland, and perhaps still farther. This strip was originally known as the "oak land," it not having a single pine among its forest growth. The strip varies in breadth from 5 to perhaps 15 miles, and was, before being cultivated, much richer land in general than the land on either side, or elsewhere in that region. After long cultivation and great exhaustion, and turning this land out of cultivation, it then throws up a growth of pines, a short-leaved kind, [and of course not the "old-field pine" of the tide-water region.] Mr. Old has a large body of this worn-out and now pine-covered land. But it is not of value for furnishing vegetable matter, as the acid pine lands are. The leaves there never cover the ground thickly, and seem to rot much faster than elsewhere. [This is an interesting confirmation of the doctrine of the antiseptic quality of *acid* soils. This soil not being acid, cannot preserve on it several successive crops of fallen pine leaves, as do acid soils.]

Mr. Old's singular two-field rotation of oats and tobacco, alternated continually, was described by one of his neighbors last year in the Farmers' Register, (p. 308, vol. ix.) The oats are suffered to fall and remain on the ground as manure for the succeeding crop of tobacco, and are found fully sufficient alone to maintain the high degree of fertility necessary for good tobacco crops. All the lots for tobacco are thus managed. Desiring to increase the crop of wheat, at one time this two-field rotation of the tobacco lots was changed to a three-field, of 1st, clover, 2d, tobacco, and 3d, wheat. But the frequent failures of wheat caused this plan to be subsequently changed to the previous oat and tobacco two-field rotation, which has been thus but lately restored. In these two rotations, and without other manure than the oats or the clover, (after the first enrichment of the land by other manure,) one part of the lots has been 17 years so cultivated, without deterioration of the land or its products. The land on which all this tobacco cropping is done, is of broad "creek flats," or low-grounds of smaller streams running into the Appomattox, (the farm does not extend to the river,) and the soil was originally very rich, though shallow. It was, as elsewhere, much impoverished by exhausting and injudicious cropping, before coming into Mr. Old's possession; but, as the result shows, is capable of being restored to fertility, fully and profitably, by self-manuring by its own growth, or by other putrescent manures applied.

Gypsum is used generally, and acts well on the high land, once in each course of crops, which is the five-field rotation of 1, corn, 2, wheat, 3, clover, 4, wheat, (on fallow,) 5, clover. *On the originally poor parts gypsum has done no good.*

Mr. Old is altogether opposed to the practice of graduated ditching on hill-sides, generally through a farm, for the purpose of preventing the washing of the land. He uses some short ditches of this kind, on very favorable positions, and as merely a partial preventive. He has seen land thus treated, which the ditches alone spoiled more than all the washing could do in a century of other judicious cultivation; and which was far more disfigured and injured afterwards, by the water breaking over the banks, as it certainly will do, with all the care that can be used. Supposing even (what is far beyond the truth) that the best arranged and constructed ditches, *always kept in perfect order*, could effect their designed purpose, of carrying off the redundant rain-water, it would be impossible, by any farmer's care, to prevent accidental and unlooked-for stoppages, which would be first made known by turning out the water of a ditch, cutting a gully, breaking by the accumulated force across the next ditch and bank below, and increasing its track of devastation thence to the bottom of the descent. As an example of the insecurity of the system, he referred to one of the graduated ditches, (such as above-mentioned,) through his corn-field, which being short, and frequently under his eye, he had several times himself examined throughout its whole length, and with a hoe removed every commencing obstruction. This care was in addition to all general superintendence and repairing. Late in the year he found that the water had broken over, and had begun to cut a gully. The cause was, that the fodder not having been gathered on a part of the adjoining corn, as it decayed on the stalks the small light bits had been blown off by the wind, and some had fallen in the ditch. The first rain floated this light stuff along the ditch, until a straw or small root, or some such thing, caught and stopped a few bits, which served to stop more; and as the muddy water settled and filled the crevices, finally made a dam sufficient to throw out the water. Had this ditch been at the top of the hill, and several other ditches below, this slight cause would have broken every one, and with more and more damage at every successive breach.

The frequent and generally increasing disasters and failures of the wheat crop in the middle part of Virginia. Mr. Old is at a loss to give a reason for. If he had judged merely from his own land, he would have ascribed it to the use of gypsum, and its supposed power of attracting moisture to the soil, as well as otherwise giving increased succulence to the growth of wheat.

Mr. Old considers that all dry arable land, even though clayey or stiff, requires grazing, to trample and consolidate the soil. He does so once in every course, and keeps a large stock of cattle,

(from 90 to 100,) for the benefit of their manure, and their periodical grazing, more than for any thing else. Besides this temporary use of his clover fields, he has a large standing pasture. He does much of his winter manuring by moveable pens, changed every week. This is done throughout the winter, during all weather in which the land to be so manured is either dry or frozen. Corn-stalks are hauled in and scattered for food and litter of each pen the first half of the week, and straw the latter half; so that the stalks may be as much trodden as possible. The size of the pen, as well as its continuance, is suited to the number of cattle and the quality of litter, so as to properly manure the space inclosed. Bushes are sometimes used to shelter the pen somewhat from the cold winds, but not generally. This mode of manuring saves much hauling, and is in other respects deemed as profitable, as from the permanent farm-yard, where the cattle are kept during all wet weather.

Gen. Peter H. Steinbergen is a farmer, and still more largely a grazier, in Mason county, on the border of the Ohio. The great object of his cultivation and great means of profit is grass to feed and fatten cattle for market. His enriching his exhausted lands by *top-dressing* presents the most successful, as well as extensive practice, in that novel and as yet much doubted mode of applying putrescent manures. The practice of the graziers in that part of the country is to manure by littering and feeding in lots, changed as often as sufficiently covered, and also on grass land. Of course, the manure is necessarily applied to and remains on the surface, and its early benefits are given to the grass, and not only for that year but for as many after as the grass may continue good, or the general plan of cultivation may permit the field to remain free from the plough. But great as has been the improvement thus made on land previously reduced very low by exhausting tillage, Gen. Steinbergen is fully convinced of the truth, that the ability to enrich poor land by putrescent manures alone, depends on the land having been originally fertile.

Gen. Steinbergen, without estimating red clover lower than its universally admitted degree of value, thinks still more highly of greensward, [*poa pratensis*]; and the superiority he claims for the latter is not only as furnishing more palatable and nutritious food for cattle, but also as a much richer green manure to the land producing it than clover. On describing to him how the sandy lands of lower Virginia, after marling, became sprinkled with greensward, he said it was then in the very state when (to nurse this grass and obtain its rich benefits) tillage should be delayed as long as possible, and the land be subjected to grazing instead. He thinks that light land should be always grazed and trampled, at least one year before tillage—and stiff land designed for tillage should never be grazed.

Dr. Corbin Braxton cultivates the very sandy low-grounds of the Pamunkey, where he has made most extensive and profitable, as well as very remarkable improvements of product, by marling with the green-sand marl—which has both the fertilizing principles of green-sand and of calcareous matter combined. As his general results, and also a general description of the Pamunkey lands, have been already published at length, (at pp. 678 and 637, vol. 8, Farmers' Register,) they will not be repeated here. And hereafter will be added some additional observations on that most valuable body of manure, and its remarkable effects. Here will be given merely a few of less important matters of conversation, and answers to verbal inquiries, though generally on subjects then under the eyes of both parties.

The opinions of all three of these farmers concur fully in the absolute necessity of sometimes grazing light lands. They also agree in the certainty and profit of enriching by putrescent manure originally rich land—or, in Dr. Braxton's case, of poor sandy land after its being marled. He has found, by experience, that it is best to graze clover pretty heavily, but still leaving a cover of (say) ankle high, the year he fallows for wheat. These very light lands, so light as to be worthless for wheat without marl, when marled and with clover fallow become good wheat lands—the best crops yielding 20 bushels the acre. After corn, the wheat is very mean, and indeed scarcely worth sowing. The Hessian fly is sure to be very injurious to corn-field wheat. The best safeguard against this insect is to enrich the land and thereby to cause the wheat to out-grow the depredations of the fly.

Before marling, all the efforts made to enrich by putrescent manures availed but little. Though all these light low-grounds were supposed to have been originally rich, farm-yard manure served to do but little good, and the effects were very fleeting. Since marling [as on all other marled lands] precisely the reverse is the fact.

Dr. Braxton is about to try to have clover to succeed his corn crop, instead of wheat after corn (as usual) and clover after wheat. This would doubtless be a capital improvement, provided clover can be produced with certainty after corn. In answer to my objections stated, of the attempt being made, for several years, in experiments at Coggins Point, Dr. Braxton considers that the Pamunkey land becomes, by the use of its peculiar marl, so favorable to clover, that there will be no difficulty in having it after corn. After clover being once sown, and the land full of seed, it takes possession of it whenever it is without cultivation, as if the most natural product of the soil. He is opposed to fall or early winter ploughing of the land, when preparing for corn. Ploughing in spring serves as well, and saves some after-tillage, which the more consolidated early ploughed land would require; and moreover, the early ploughing is thickly covered by spring with young clover, all of which is killed by the first tillage. Later ploughing would cause much less seed to germinate, and be therefore destroyed.

The Eastern Shore bean grows very kindly on these lands, after marling, and instead of being prized as an improver, is denounced by Dr. Braxton as a worthless weed, obstructing the growth and lessening the product of clover, the great green crop for manure, which he values far beyond all others as an improver.

Dr. Braxton esteems the ruta baga turnip crop very highly, and deems the sugar beet as comparatively worth very little. Besides the value of the ruta baga crop, for stock, when secured, he thinks its product almost certain, on his land, with proper management.

When on his farm in November, 1840, I saw a

novel mode of following ruta baga by wheat, or rather having both crops growing at once. On a rich part of the clover land fallowed for wheat, ruta baga was planted in rows 4 feet apart, and cultivated by ploughing and weeding. In October, when a fine growth of turnips was on this patch, (though no manure had been applied, except the green clover turned under,) wheat was sown here at the same time with the adjoining part of the field, and the seed ploughed in, between the ruta baga rows. The roots were afterwards taken up, when grown and required for consumption. Dr. Braxton left home before the wheat was reaped; but from its previous appearance, as well as his overseer's report, he thought the product not much lessened by the growth of turnips.

OBSERVATIONS AND ROUGH EXPERIMENTS. 1841.

For the Farmers' Register.

1. *Gypsum.* On March 26th, 21 bushels of pulverized gypsum (French) sown at the rate of a bushel per acre on clover of second year's growth. Soil, originally acid and very poor; a light loam on sandy subsoil, well marled in 1824, since manured, and altogether improved, from a product of 6 bushels of corn per acre to 25 or 30. The clover crop mean, and after June 1st, freely grazed. No benefit whatever perceived on a comparison with the adjoining clover not dressed with gypsum on a soil exactly similar.

2. *Green-sand.* At the same time, in the same field, on similar soil, and on clover of same growth, one acre dressed with 40 bushels of green-sand earth (not calcareous,) from James river. No effect produced.

3. In March, eight acres of good loam, marled 10 years ago, product in corn supposed equal to 30 bushels, and in wheat after clover 18 or 20 bushels, were dressed with green-sand earth at the same rate. Two beds left out. Clover in its first year. No perceptible benefit.

4. *Seed wheat.* Having seen *old* seed wheat recommended, by several contributors to the Register, of the crop of 1840, the grain of which was very good, a small quantity was kept in good order and carefully guarded against all danger of heating, or other injury. This fall, 12 bushels sown in a field of uniform and good quality, and immediately adjoining *new* seed of same kind (purple straw.) The sowing of both kinds commenced and finished in the same day, and operations in every respect conducted exactly alike. Quantity to the acre the same (5½ pecks.) The old seed *a little* weevil-eaten, notwithstanding every care used in keeping it, but not enough so to be much objectionable. The old seed longer germinating, and to this day, December 31st, looks decidedly inferior to the wheat from new seed.

5. *Top-dressing with farm yard manure, and with unprepared leaves.* Eighteen acres of light sandy loam in clover of 2d year, very thin and very unpromising, was top-dressed in April, 1840, with rough and unrotted manure from the farm-pen, at the rate of 800 to 1000 bushels per acre. This land was marled in 1821, and though greatly improved, (for before its product was 8 to 10 bushels in corn, and perhaps 3 in wheat,) was still but of middling product, and before this manuring, would not have brought more than 18 or at most 20 bushels of corn per acre, or 6 bushels of wheat after corn. The last crop of wheat, cut in 1839, after corn, was known to be only 42 bushels of wheat or 2⅓ bushels to the acre. That crop however was very much damaged by chinch bug. The top-dressing was as coarse as any trodden litter could be, many corn-stalks merely mashed, but unbroken, constituted an average of the manure of the farm-pen, which was made of the stalks and straw of the farm-pen trampled by the cattle, and covered over with the manure of the stables and hog-pens every time they were cleaned out throughout the winter, which was about once a week. The hog-pens were principally littered with leaves from the woods. The effect of the top-dressing on the clover was almost immediately perceptible. In September the field was fallowed for wheat, and in June of this year 283 bushels of wheat were cut from it, equal to 16 bushels per acre. The soil is decidedly a corn soil, and too light for wheat. But the most striking and gratifying proof of improvement is the frequent appearance of green-sward in many places, where it was not at all observed prior to this manuring. This valuable grass has generally made its appearance in spots in the different fields after marling, but this particular field was too poor for its growth (so as to be noticed) even after marling, until it received this top-dressing.

6. In January, 1840, about 15 acres of light loam, with sandy subsoil, in clover of second year's growth, top-dressed with 377 very large ox-cart loads of leaves, principally pine-beards raked together in adjoining woods. The covering was so thick that at one time it was thought that the clover was in great danger of being smothered. It however came through and was decidedly benefited, except in spots where the leaves were left too thick. In the fall, the whole was fallowed for wheat. Crop 15 bushels per acre, and considered a good yield for the land. Its product after corn has usually been about 8. Part of this land was much infested with wire-grass. In getting in the wheat no means adopted to get rid of wire-grass, except to pick up and carry off the little that the harrows brought to the surface. And in fact this piece received one harrowing less than I usually gave to such wire-grass spots, on account of a rain which interrupted the operations. This fall, 1841, in ploughing for corn, noticed that very little wire-grass was left. Could the leaves have had any agency in killing the wire-grass, by shading or otherwise? Or did the mere exposure of the roots to the sun, as some maintain, effect it? Some credit is no doubt due to the latter cause, but the former has a strong, and, may be, a stronger claim; for, in similar spots, fallowed without any application of leaves, I have never known a similar decrease of wire-grass. It may be well to mention that the above 15 acres were 10 or 12 years ago well marled—the soil, originally and previously to marling, acid.

7. *Leaves ploughed under.*—In January, 1841, covered a stiff, intractable soil, previously and some years ago well marled, with leaves, which were ploughed under, and oats sown early in

March. No benefit to the oats whatever; and when ploughing the land for wheat this fall, the leaves were turned up very little decayed.

E. RUFFIN, JR.

[The foregoing statements were furnished upon our suggestion, and in regard to most of them in consequence of our seeing or otherwise knowing the general results, and deeming them the more worth notice, because of our personal acquaintance with the original condition and character of the land, which was the subject of our own early labors and improvement by marling. Though the written memoranda of the writer furnished the by-gone but recent facts nearly as here stated, still, as *accurate experimenting* had not been at first designed, and still less any publication of results, it is not pretended that the statements of quantities are entitled to the respect due to the results of carefully and properly conducted experiments.

We have another and more general reason for presenting these notes of observation to our readers. It is to show that by merely noting down, in the most concise and simple form, any results or facts observed deemed worth remembering, any practical cultivator might aid in furnishing a mass of interesting facts, or suggestions of subjects for inquiry and more careful experiment. There are hundreds of our readers, who never report any thing for publication, who might in any half hour, furnish some few such observations, which, *as facts*, and still more as having the authority of the name of the observer, would attract general attention, and convey much of useful suggestion, and induce imitation and co-operation in the pursuit of doubtful truths—all tending to cause the making of properly conducted and accurately reported experiments. Will each one reader, who may acknowledge the value of such operation and results, do something towards producing them?—ED. F. R.]

For the Farmers' Register.

LIQUID MANURE.

In the December number of the Register, I notice detailed a number of interesting and conclusive experiments, make by Mr. Milburn of Yorkshire, in the application of liquid manure. In the fall of 1840, after cleaning out my standing farm-pen for the winter reception of my cattle, there was left in it a quantity of dark rich liquid, which I felt inclined to apply to a neighboring field, then in young clover of first year's growth. With much the same primitive contrivance of pails and barrels placed in tumbril carts, as used by Mr. Milburn, I contrived, with much inconvenience, to get out most of the liquid. It was spread very unequally, and I cannot say at what rate. In many spots where the application was too heavy the clover was killed outright, but was succeeded the next spring by a most luxuriant growth of weeds. Generally, however, the clover was much benefited. This fall the field was fallowed, and sown in wheat. On the part where the liquid manure was applied the wheat now exhibits a decided superiority. I have no sort of doubt of the highly enriching quality of the liquid, and of the great annual loss suffered by our farmers when it is allowed to run off into the nearest gullies, or carefully drained off to the adjacent ravines, in order to render the working of the manure more comfortable to the hands. In every properly shaped farm-pen, each spring and fall, when it is cleaned out, there will always be found a large quantity of this valuable liquid, which can be easily carried out by the simple contrivance recommended by Mr. Milburn. I think this single article, above referred to, is worth to every reader of the Register, who will adopt and act on its suggestions, more than the subscription to its whole series. Z.

Jan. 6, 1842.

ON SOILS.

From the American Farmer.

Mr. Editor:—Will you accept of a few hasty and indigested remarks on soils and their properties of production? Such as they are, they will be very much at your service; but I must claim for them the indulgence of yourself and readers, as they are written *currente calamo*, and without being transcribed or copied.

In the American Farmer, No. 38, of the current volume, I observe that you have copied a short article from the Encyclopedia Britannica, concerning a very fruitful soil in the county of Caithness.—Such soils have been found, in the alluvial formation, in different parts of the globe—such is that of Ormiston, in East Lothian; such is that of Somersetshire, in the low lands, near the opening of the river Parret into the British Channel; some of the lands of East Florida, possess the same properties; and to come nearer home, some of the land of Spesutia Island, in Harford county, possesses the same inherent quality of production.

Now as to the theory, by which this extraordinary fertility is explained, in order to form a rational and correct one, we must take into view all the connecting circumstances. The soil described by the writer of the article under consideration, is said to consist almost entirely of broken shells and fine mould, the latter in almost an imperceptible proportion—that from Ormiston afforded, by analysis, eleven parts in the hundred of mild calcareous earth, twenty-five of siliceous sand, forty-five of finely divided clay, nine of animal and vegetable matter, and a small quantity of phosphate of lime, to which latter its fertility is in a great measure attributed.

The soil from the low lands of Somersetshire has been found to consist of only one ninth of siliceous sand, and *eight ninths of calcareous marl*, with five parts in the hundred of vegetable matter; *and its fertility is attributed to its power of attracting principles of vegetable nourishment from the atmosphere, and from water.*

Much of the secret of fertility of soils consists in their power of attraction, &c., as observed in the foregoing paragraph. All soils are not capable of being rendered thus *artificially* fertile—much will depend on location, whether level or undulating—much on the structure of the sub-soil and its capacity of retaining moisture; and where there is not an approximation to correct proportions, essential to fertility, the labor and expense of rendering them fertile would not be counterbalanced by their productiveness.

The attractive or absorbent property of soils has probably not been sufficiently attended to—that lime, in some form, is essential to the fertility of soils, and to their power of absorbing nutriment from the atmosphere, all experience testifies; and it is that portion of the soil which, next to vegetable mould, is most subject to loss, as well by its affording an essential part of plants, as by being gradually washed away by rains, &c. In illustration of this latter process of waste, I will mention a circumstance that has lately come within my observation. Last fall, in November, I had the roof of my kitchen covered with a thick wash of lime. A north-east storm came on before it got dry, and washed a considerable portion of it off. A window was so situated as that the droppings from the eaves were driven against it—these droppings held the lime in solution, which was beautifully crystallized on the glass—this may serve to show that the calcareous part of soils is gradually wasting. Nearly all grains contain a portion of lime, some a large portion; and they can obtain it in no other way than from the soil.

From the foregoing observations it must be apparent, that in such cases where the soil does not originally contain a large portion of lime, it will be proper, occasionally, to renew the application; and I am decidedly of opinion, that when it is intended to apply one hundred bushels to the acre it should be applied at three or four different dressings, at intervals of three or four years, as by this mode the greatest advantage will be obtained, at a given expense.

Some plants, more than others, possess the power of attracting from the atmosphere the substances essential to their growth. The house-leek, (*sempervivum,*) is a remarkable instance of a plant possessing this power—such plants, it is presumed, contain but little lime. Not only plants, but some animals of a low grade of organization, possess the power of attracting substances from the surrounding elements, essential to their growth—the oyster is an instance of this—without the power of locomotion, attached to a rock, the sperm of the oyster has the power, not only of attracting all its food from the surrounding elements, but of forming a calcareous shell for its future habitation.

But to return to a consideration of soils: it must be apparent that they should, in order to be fertile, be made to contain the food of plants, and at the same time be so constituted that they should possess the power of attracting it from the atmosphere. Many of the articles that have been found to contribute greatly to the growth of plants, cost the farmer too much, and they are of too transitory a nature. Such are *crushed bones, and poudrette*; substances, imparting astonishing fertility for one year, and where they are within a reasonable distance of transportation, will pay in one crop. It has been thought, and I should like to have the experiment fairly made, that ground oyster shells would answer nearly the same purpose of ground bones—oyster shells, though affording pure lime by calcination, differ, essentially in their properties from lime-stone. They are composed of a carbonate and phosphate of lime, and contain a portion of gelatine, or fibrine. It is hence concluded that while they would, when ground, act almost as quick as crushed bones, they would be more durable, at one third, perhaps one fourth the expense.

The most astonishing and negligent waste is attendant on the city of Baltimore, in permitting for years the essential material for *poudrette* go to utter waste and loss. Many thousand dollars are thus annually lost for the want of knowledge and enterprise. No speculation that could be entered upon at this time, would be so sure to reward its undertakers as the manufacture of poudrette in or near the city of Baltimore! Individuals have probably been deterred from entering upon it by the elaborate descriptions that have been given of the process, and the apparently large capital necessary to carry it on, whereas nothing can be more simple than the process, and no business so sure of extensive profits that could be conducted at so small an expense. It is to be hoped that some enterprising agriculturist will take the hint and make a princely fortune by it.

From the great difference of the causes that influence the productiveness of lands, it is obvious that all the favorable circumstances are rarely found to be united in any soil; but by a due attention to the component parts of soils, by chemical tests, by careful observation and experiment, we may generally be enabled by adding such parts as are deficient, to give fertility to those that are naturally sterile. It is to the earthy parts of a soil that we are to turn our first attention, and when these are formed in due proportions, its fertility may be considered as permanently established. The animal and vegetable portions are but temporary, and are exhausted by a given number of crops. Those soils must be considered best which contain the greatest store of those principles that constitute the food of plants, permanently inherent in their quality—Calcareous soils, by their constant attraction for carbon are of this class; and if they at the same time contain animal and vegetable substances, are more eminently qualified for this purpose by the supply of carbon and hydrogen which they afford. H.

Wood Lawn, February 14, 1842.

REMARKS ON A PRECEDING COMMUNICATION ON BERKSHIRE HOGS.

We are so well pleased to have so judicious and practical a farmer as the Rev. J. H. Turner, for the first time a contributor to the Farmers' Register over his own signature, that we have no inclination to find fault with any thing he says, or to defend our editorial course from his strictures. But respect for himself forbids our passing over his remarks in silence.

If it were not that our intelligent and highly esteemed correspondent had so much mistaken our remarks, at page 17 of this volume, we should deem it sufficient to refer to those remarks for our defence against his charges. It is strange indeed that we may not dare to denounce humbuggery, even where every intelligent and candid observer will admit it exists, without being deemed an opposer and enemy of the really valuable improvement on which the humbug is built. We have repeatedly, and especially in our remarks in question, admitted our belief in the Berkshire hog being a valuable breed, and of course its introduction and diffusion being an important benefit to agriculture; and so far as our interest is now connected with practical agriculture, we have acted on that belief, by beginning to raise Berkshires, though thereby supplanting another previously very highly prized breed. Nevertheless, this favorable opinion is not incompatible with another, to wit, that this breed of hogs has been praised and puffed much more than it deserves, and to subserve the self-interested views of salesmen; that there has been a deal of puffing, falsehood, and deception, for this same end, and that too practised by some of the most noted breeders and salesmen; and, in short, that there has been so much humbuggery practised in this respect, by those salesmen, that they, while filling their pockets at the expense of their dupes, have almost stifled the truth, and hid the real value of the breed, by the overlayings of falsehood. We know how much mankind dislike to be made to know that they are cheated; and that he who cheats them will always fare better in their opinion than he who endeavors to expose the cheat. But while we expect, and are resigned to the fate of getting "more kicks than coppers," or more curses than thanks, for our attempts to expose humbug, it is inconceivable to us how such a man as Mr. Turner can so far misconstrue our course and its object, and consider us as opposing true improvements of stock, or improvements of any branch of agriculture, because we oppose, and try (vainly) to expose, those who are perpetually using such real or alleged improvements to make dupes, and obtain ill-gotten gain for themselves. When we have to seek for the true benefactors of agriculture, it will not be among the Bements and the Lossings, any more than the Thorburns, the Physicks, the Princes and the Morrises.

Absence from home, when the letter of Mr. Turner was put in type, prevented these remarks being placed at the close of his communication, as would have been more appropriate.—Ed. F. R.

THE ADAPTATION OF PARTICULAR WHEATS TO PARTICULAR LOCALITIES.—PATENT MACHINES.

For the Farmers' Register.

In a late number of the Register, Mr. Carter suggested the benefit to be derived from the change of seed wheat. On a former occasion, I endeavored to draw attention to this subject, and finding that it has now attracted some notice, I shall give an account of the wheat most successfully grown here. From my early recollection till the year 1798, when the Hessian fly first made its appearance in this district of country, the white Washington was the general crop. Its destructive ravages induced many farmers to try other varieties; but it was soon found that this pestilent insect made little distinction. The late Col. Edward Hays, of Talbot, who was much devoted to agriculture, and fond of experiments, for some years abandoned the growth of Washington wheat: he afterwards got seed of me; and said, at a later period, he had tried many varieties, but had found none so valuable, and productive, as the Washington wheat. The grain is white, and makes the best family flour; the straw is soft, and both horses and cattle prefer it to any other wheat straw. It only grows well in salt-water districts. If carried into the interior it degenerates, loses its color, and becomes chaffy. For the last fifty years to which my recollection runs, this has been the principal crop on the farm where I now reside, till last year. About six years ago, supposing that changing seed with a neighbor might be beneficial, I got a few bushels of the same sort of wheat. Though he was ignorant of it, his wheat contained a small portion of smut, which soon infected all my white wheats; and after some fruitless attempts to clean it, I was under the necessity of abandoning its growth. Some of my neighbors, who have suffered in the same way, are now raising seed picked by hand, and as soon as I get pure seed, I shall sow it again. I have supposed this wheat would suit on some of the salt-water districts in Virginia. About thirty years ago, a wheat was introduced here, and is known by the name of the red chaff beard, I apprehend the same mentioned by Mr. Carter. It seems adapted to a variety of soils, and is more generally grown in this county than any other. It ripens early, though sown late; and suffers less by the frost, especially on low, wet grounds. For these properties, it has been part of my crop for many years, though it sells at a much inferior price in the Baltimore market. When my white wheat was infected with smut, though this was thrashed by the same machine, cleaned with the same fan, and stored in the same granary, it did not contract the disease. An experienced farmer, to whom I mentioned this circumstance, informed me that his white and red wheat had been equally infected.

A farmer always incurs risk by changing seed. When I abandoned the growth of Washington wheat, I purchased white flint from a gentleman in the neighborhood, who got the seed from New York in 1836, and had grown it exclusively on his farm. He had no suspicion of smut; but upon careful examination, I found it to contain a small portion, and declined sowing it. I then procured Pennsylvania white wheat, which has been lately

introduced here: it does not ripen early, and I do not think produces equal to the Washington, or red chaff.

I last summer saw some Chester county farmers in Washington, who stated that they grew there a wheat which they called the Mediterranean, which, though sown the last of August, would resist the Hessian fly. Dr. Darlington, a gentleman of science and intelligence of West Chester, confirmed their statement; and I purchased a few bushels, which I have sown for experiment. I have also sown a small quantity of white wheat which I procured from Owego county. It has a fine white grain, and much resembles our Washington white wheat.

From reading, and not from experience, I have been induced to think, that the change of seed wheat is beneficial. The Scotch farmers often import seed from England, and Scotchmen generally understand their business. I cannot undertake to say that the white Washington or red chaff beard has degenerated on my lands; on the contrary, when the season is favorable, I have found them equal in weight and product to what they were in my earliest recollection. My theory is, that there are certain soils to which particular varieties of wheat are best adapted, and when this is ascertained, it is always safest to rely on those varieties. If it be true that wheat adapted to a soil degenerates from long sowing the same seed, raised from the same ground, I should prefer the same variety from a remote place. I have seen some beautiful parcels of wheat brought into this neighborhood, which very soon degenerated. Some years ago, Judge Thomas Buchanan sent me, from the highlands of Washington county, some beautiful white wheat, from which I had formed high expectations; but it very soon degenerated, which I attributed to its not being suited to this soil. Upon the second introduction of red wheat, after Mr. Carter had ceased to sow it for fifteen years, he found it to produce well; and when the product first diminished, it is probable if he had gotten seed of the same variety from a distance, he would have derived the same benefit. The adaptation of certain varieties of wheat to particular soils is proved by the Washington wheat growing in salt-water districts, and degenerating when carried into the interior. Mr. Carter illustrates the necessity of the change of seed wheat by analogy to animals. It is now generally agreed that horses, cattle, sheep and hogs degenerate from long exclusive association. If from this cause a herd of Durhams had depreciated in value, I apprehend if one of the same herd was introduced when the connexion had been long broken, the cross would be as beneficial as if made by a Devon. I am well satisfied that the white Washington and the red chaff wheat are best adapted to my lands, and though I am not sensible they have degenerated, I should be pleased to get seed of both or either from a distant region, for experiment.

The community stands much indebted to Mr. Garnett, for his persevering efforts in the cause of agriculture; and I am pleased to find that an agricultural convention has met in the city of Washington, which has framed a constitution, and organized a society; though, I much fear, it will languish for want of funds. Agriculture, though the paramount interest of the country, and extending into every section, it seems is not so connected with *the general welfare* as to be entitled to the countenance of the general government. Perhaps one of the causes is, that no demands have been made. If I was a member of this society, I would bring the subject before them at their next meeting, to see if something could not be made out of this clause of the constitution. The manufacturers, though for the most part a sectional interest, placed themselves under its fostering wings, where they would still have remained, but for the ardent and determined spirits of the south. I am not a latitudinarian in construction; but there are many problems in agriculture not solved, many discoveries not assayed, for want of means, and I think an appropriation to these objects would be more for the general welfare, than sending ships on discovery to unknown seas, even if they should be so fortunate as to find an island within the Arctic circle.

Among other new discoveries, the wheat drill was presented last year. The patentees are Pennsylvanians, from Chester county. They stated that, in their richest lands, one and a half bushel had been found sufficient seed; on my improved grounds I generally sow two to the acre. I had a few acres put in at the rate they proposed, alternating spaces, with the plough, in which I sowed two to the acre. The next harvest will test the accuracy of their statement. I kept the time of the work done by the drill, for two successive hours, and found it would plant one acre to the hour, with two men and two horses, without fatigue to either. It deposites the wheat and covers it by the same operation; and none can be found on the surface. The saving in labor and the saving of seed are no small considerations. I was much pleased with the work done by the drill. It is somewhat complicated, and I have not sufficient information in mechanics to determine on its stability, and whether it can sustain the rough usage of rough hands.

It appears to me that there is great defect in the patent law, and I think the subject not unworthy the consideration of the National Agricultural Society. The commissioner is directed to award a patent if the machine or composition of matter *be new and useful*. By examining and comparing a machine with the models in his office, he can determine if it be new; but he has not the science, experience, ability, and means of experiment, to determine on its utility; which does not depend only on its apparent fitness for the work intended to be performed, but its ability to sustain it in continued practical operation. I do not speak from any personal knowledge of the master of patents, but it would be rare to find a man possessing all the requisite qualifications. The Patent Office ought to have attached to it a scientific practical chemist, and a scientific practical mechanic, (with salaries to command the best abilities,) who should be provided with full means for experiment. In the departments under the general government, where the general welfare is concerned, no reasonable expense ought to be spared. Patent machines and patent medicines have long been a gross imposition, and must so continue, until the Patent Office shall be put under better regulations. If the wheat drill had passed through the Patent Office under the inspection of men competent to decide on its usefulness and durability, though the price is $100, I would purchase one for the next

season ; for I entertain no doubt but the saving of labor and seed in two crops would clear the cost.

WM. CARMICHAEL.

Wye, Queen Ann's, Md., Feb. 17, 1842.

ADDRESS TO THE AGRICULTURAL SOCIETY OF MASON, CABELL AND KANAWHA.

By Gen. P. H. Steinbergen, President.

Gentlemen of the Agricultural Society:—Let me congratulate you that we have again assembled under the rules of our society. It affords evidence of continued zeal to the cause of our association, and furnishes at the same time an opportunity, highly pleasing, of friendly social intercourse among its members. Such meetings are well calculated to give life and animation to the prosecution of that great interest in which we are engaged. By means of premiums to successful competitors, we can tempt the spirit of rivalry, and stimulate to increased exertion.

The farmers of this nation are the sheet-anchor and support of every other great interest of society. On their broad shoulders rests the superstructure of national wealth and prosperity, and to their success or failure you may justly look, as to an unerring index, for the condition of the whole community. How important then it is to us, that we should possess the lights of experience, in order to guide our operations! How important that those operations should be conducted upon settled principles, drawn from well authenticated facts, suited to our local circumstances. I hope that several of you the past season have given your attention to this primary duty, and will report to this meeting such actual experiments as you have made, and believe conducive to our interest. If every member would pursue such a course, we could soon make a depository of useful information available alike to all.

During the last summer some facts came under my own observation, that have peculiar and appropriate relations to the condition of our country. I had always supposed that the soil of this section of the state was deficient in calcareous matter, but from some experiments lately made on my farm by Mr. Briggs, one of the assistants of Dr. Rogers the geologist of this state, he has completely satisfied me of the actual existence of lime, with various combinations, and in situations where I had never before suspected it to be. With a vial of muriatic acid in hand, we carefully examined the whole chain of rocks cropping out of the river hills bordering on the bottom ; and frequently applying the acid to such rocks as he indicated, they would rapidly foam, or effervesce, showing to a certainty the actual presence of lime. In some places we found the rocks combining nearly equal parts of lime and sand ; and the same vein or ledge, on pursuing it horizontally, would evidently change its character to ferruginous, indicating thereby combinations of iron.

The very best specimen of calcareous earth we found, or that I believe our country produces, is on the bosom of some of our river hills. They are those red, naked barren-looking places generally spoken of here as "*buffalo stamps.*" There is one near my house, and on it much fine, pure, limestone gravel ; the red earth freely effervescing with acids, and apparently so highly calcareous as to produce no vegetation whatever.

I must believe that the discovery of this calcareous earth may be made of vast importance in the future improvement of our soil. Its application to our sandy land particularly, when in a sod of grass and previous to turning under for corn, would surely add greatly to its production. I shall, on the first proper occasion, try the effect on some of my fields, and report to you hereafter the result.

Further and more extended observations since Mr. Briggs left the neighborhood have enabled me to trace several ledges of tolerably good limestone, (combined with sand as usual), at the distance of two or three miles from the river. Finding such specimens thus located at different angles around us, I am now satisfied of the existence of sufficient calcareous matter in our soil for all the purposes of good husbandry and profitable farming.

It is the opinion of geologists, that the character of a soil is determined by the rocks that lie underneath it, the soil being formed by the disintegration or decay of those rocks. If such is the fact, water percolating through them will carry off carbonate of lime held in solution ; and that same cause thus operating for ages over the rocks, must have incorporated considerable calcareous matter in the soil. You will have observed, that under those ranges of rocks so common to our creek and river hills, you see the land is very frequently as rich as our best river bottoms ; and to what other cause than the one before mentioned can we attribute the fertility that is known to exist in that particular situation?

Our alluvial bottoms, formed originally by deposition from the river, and almost annually inundated, have naturally been manured by the deposite, containing more or less of every substance over which the water should happen to have passed before reaching them. In this way we can readily account for the unsurpassed fertility of the upper Kanawha bottoms. It has been the first receptacle for the wash from the limestone region above ; and the component parts of the soil formed by chemical combinations of the most fertilizing of all manures.

If we are fully satisfied of only a small part of calcareous matter present, we can enrich our soil to any desirable extent by the application of vegetable substances ; and in what other way can they be more readily obtained, than by sowing clover and other grasses? It will always be in your power to make a direct use of your clover sod, by turning it under, with such other materials as your care and attention may have enabled you to save for that purpose ; or you may pursue with your grass the system of grazing cattle, making them the principal auxiliaries in enriching your estate.

I had a good opportunity the last summer of comparing the relative merits and advantages which different principles of farming produced in various parts of this country ; and as the result of my observation has added to my previous conviction of the utility, profit and advantage arising from grazing, as well as the vast y increased

fertility and improvement of those farms on which it was judiciously practised, I will here state somewhat in detail such consequences as I observed growing out of each system.

My tour extended from the James river to the Potomac, in the Valley, and through a part of Loudoun county.

It is well known that nearly all the Valley of this state is highly calcareous, based on limestone rock cropping out in many instances so as to obstruct agricultural operations. To me, in some instances, it was matter of perfect astonishment, that with the materials of inexhaustible fertility lying in profusion around them, I observed some fields going to waste and profitless ruin, from the want of clover and other grasses sown upon them. I perceived that even there, where the land was certainly calcareous, if they failed to combine the vegetable matter, all their efforts at general improvement were given to the winds; as they had added nothing to stimulate into active use the fertilizing properties of the lime.

I saw, in various situations, huge mounds of calcareous tufa, or travertine. This is deposited from water holding carbonate of lime in solution, by means of carbonic acid. As the excess of the acid escapes, as it does generally at some fall or ripple, the lime is deposited in the form of an impure porous carbonate, frequently encrusting stones, leaves, and sometimes trees. Never, I believe, has the hand of Providence placed any other substance of such utility to agricultural purposes, more readily at the command of the farmer. It is easily calcined, and then used as lime; or may be readily ground like plaster, and applied in large quantities on clover sod previous to turning under. In no instance where it exists in such abundance could I learn that it was used for any purpose whatever.

I could wish, for the future welfare and future improvement of the spot of my nativity, that Mr. Ruffin, the editor of the Farmer's Register, would at some time extend his trips up into the Valley, and bring into active and general use this treasure, now neglected and unnoticed.

It is thus, that often the treasures of our country lie dormant and unknown, from our not having proper agricultural surveys to bring them to light, life, and usefulness.

I found on every estate, where due attention was paid to grazing, and alternating their crops, evident improvement, particularly when aided by the grazing of cattle, long considered there as almost indispensable to the perfect management of their lands. In Loudoun, through their cattle, wheat, clover, and plaster, an impulse has been given to good farming, unequalled, I believe, by any county in the state. I there saw with pleasure, lands that I well knew thirty years ago, then poor, exhausted, gullied, and worn out, now perfectly reclaimed, and covered with cattle and most luxuriant crops of grass. I was satisfied, by comparing their oldest grazing farms with those more recently converted into them, that it was to that system mainly they were indebted for their high state of fertility. The use of plaster first gave them clover, that created the necessity of buying stock to consume it; and the continued repetition of the use of both has now produced such consequences as evidently justify the wisdom of this practice. But little corn is raised; wheat and cattle are staples of the best managed farms. Their oldest pastures are now well combined with green-sward, indicating increased fertility. It enables them to compete successfully as graziers with any other part of the state, and sell annually upwards of twelve thousand cattle.

To that county I may justly appeal for full evidence of what may be realized by the use of clover and its concomitant advantages. We have seen her exhausted fields reclaimed and made productive, her people prosperous and increasing in wealth, number, and resources. Why should we not profit by her example? I have no doubt that we now possess a much finer natural soil than theirs, and containing more calcareous combinations, the converting agent of vegetable matter. Our rolling hills and alluvial bottoms present a noble field for continued improvement. They now invite the fostering care of good husbandry. Let us then take counsel from that experience of others which is before us. Let us pursue that course which will surely increase the fertility of our land, and carefully avoid such a suicidal policy as would allow any part of our land to remain uncovered with clover or other grasses.

In thus urging on you the propriety of sowing grass on all occasions as the first move in a course of regular improvements, I would remark that proper care and attention should always be given to other resources at your command as auxiliaries, to be applied when necessity and circumstances may indicate. Your cornstalks, straw, hay and barnyard manures have their appropriate place, and time of application, in a correct rotation of crops.

The weeds that annually spring up on every farm should be cut before they mature their seed. Nothing more exhausts your soil, and prevents the formation of a good sod.

I will here warn you to beware of the blue thistle and ox-eye, two of the most foul and noxious weeds I know. They have topped the Alleghany on their march to the west, and high waters in a short time will assuredly float their seed among us. Declare a war of extermination against them at sight. Care and attention given in time can prevent their spreading, and hold them in subjection; but if neglected they will take entire possession of whole fields, to the utter exclusion of every production. I have seen whole sections of the state so polluted with these weeds, as very materially to lessen the income and value of the land.

The last season has very generally proved unfavorable to the maturity of wheat. In the Valley and in Loudoun, I was informed, that the early spring gave indications of a most abundant crop. At harvest I found those promising appearances blasted, and universal destruction occasioned in that county by the rust.

Our crops this year have certainly excelled that fine wheat growing region. As I returned to the west, I observed a change commence at the North Mountain, and gradually improving to the Ohio.

Some experiments were made last year by Mr. McMullin, a member of our society, with a view of ascertaining the best period for seeding wheat. A part of his crop was sown on the first day of August, another part in September, and the balance in October. The product has

proved very different. The first sown entirely escaped the rust, the straw unusually bright and clear, the grain full and plump, equal in quality to any produced in our best seasons—second time of sowing succeeded next—and the last materially injured by rust. This trial, however, I do not believe entirely decisive, because the last peculiar season has had great influence on the final result. Further experiments ought to be made and reported. It appears to me that the time of sowing wheat should be regulated to avoid, if possible, the two greatest evils by which our crops are endangered. I mean the fly and winter killing. Very early sown wheat will get firmly rooted before winter, if it should escape the fly; on the contrary, late sown is full as liable to receive injury by freezing out.

I would look to the particular character of the soil to determine when is the correct time of seeding it, for heavy clay land is more likely to be thrown up than light sandy soil; sandy soil retaining less water. In comparing the several casualties attending our previous crop of wheat, I am induced to believe that the chances are most in favor of the early sown producing the best crop. Make your land rich, and the fly can do no injury compared to the risk you will hazard in delay, from rust and winter killing.

I expressed my sentiments so fully in my last communication on the growth and culture of the corn crop, that I will now say but little on that subject. I yet entertain the opinion that the best preparation that we can give to land, to produce the greatest yield, should be applied when it is in a grass sod, and previous to turning it over. Whatever efforts are then made to manure and enrich the soil, the benefits resulting therefrom will be immediate and direct. I consider that deep ploughing at the same time is essential, and almost of equal importance to secure a successful crop. In no other way can we guard more effectually against the withering influence of our dry seasons, than by thus creating a depth of mellow soil, which repels its effects by lessening evaporation.

The advantages resulting from the growth of the root crops are now justly appreciated by those who have given most attention to their culture. Rising in importance in every section of the country where they have been tried, they are there considered an indispensable crop to every well conducted system of husbandry. They have proved admirable food for cows. I saw in a Philadelphia paper a publication, stating that the best lot of winter butter ever offered in that market was then exhibited, and had been made entirely from the sugar beet. Several members of this society have cultivated these crops with great success. To their experience I will refer you for practical information in regard to this culture.

I would again recommend enclosing your wood land, and converting it to standing pastures, by cutting off the small timber, and then thickly seeding it all with grass. My own experience convinces me of the great benefit resulting from adopting such a course. Those pastures that I have heretofore made, improve under grazing, and certainly will repay the amount of labor expended on their formation. I am so satisfied with the experiment, that I shall continue to increase them until all my hill land is converted into profitable pastures. Other opinions, in aid and in confirmation of my own judgment, will induce me to persevere until its final accomplishment. A gentleman who had carefully examined our hill land, and the grass growing on it, expressed his admiration at the prospect, and stated his firm belief of its capacity to rival Kentucky in good grazing. I have great confidence in his intelligence and opinion on that subject, as he is himself an admirable grazier, and well acquainted with Kentucky.

There is nothing that gives more security, or adds a greater ornament to a farm than good fencing, when judiciously arranged. The great convenience which we now have of getting rail timber, or other materials, for its construction, should induce every farmer to make substantial enclosures. How often have we seen ill-will created, and the peace, quiet, and harmony of neighbors disturbed, from the want of such adequate fencing as would give security to their crops. Very few can bear with much patience trespasses daily committed on their property, without complaining; and yet it most frequently happens, that they alone are in fault, through their own negligence and bad management, for all the injury that they have received. The law, as it now exists, permits stock to run at large, and it is your first duty to yourself and your neighbor, to guard against their depredations, by making such adequate fences as will secure your crops.

I have sometimes observed, that through inattention and carelessness to the duties of good farming, briers have been permitted to grow up in fence corners, and not unfrequently to extend over whole fields. Such negligent conduct is justly reprehensible; for surely if our land is of any value to us, it is worth our attention and protection. Nothing is easier to keep under, or even to extirpate entirely from a field, than briers. Sow your land thickly in grass, tread it with stock, apply the scythe when required, and avoid ploughing until you have a perfect sod. To lighten up the soil by the plough is to increase their growth. Their destruction is only effected by binding with grass.

The exhibition of yesterday has satisfied me, that increased energy and activity has been already given to the productions of the country by the operations of this society. The fine stock shown was creditable to their owners. The root, grass, and grain crops as abundant and productive as the season would justify. But it is in the department of female ingenuity and taste, that we are delighted to find the principal sources of the interest and pleasure belonging to our exhibition; and to the ladies would I award the greatest praise, justly earned by their spirited exertions. The number, beauty, variety, and superior quality of all the articles presented by them for premiums, were objects of just admiration to all who saw them. We earnestly hope that they will continue their exertions, and we well know, that when aided by the ladies, our cause will prosper

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ROTATION OF CROPS.

To the Editor of the Farmers' Register.

Much has been said and written on this subject, and not without cause; for of all the matters which necessarily engage the mind of the reflecting farmer, it would be difficult to suggest one more important. Besides the editor himself, many successful farmers and able writers have expressed their views in full on this subject throughout the whole series of the Farmers' Register; for example, Messrs. Carter, Selden, Wickham, Harrison, Roy, Tabb, Braxton and many others, whose names have only to be mentioned at once to arrest attention and give weight to the views advanced by them respectively. These gentlemen live, nearly all of them, in *grain-growing* districts of old Virginia, are good agriculturists, by which I mean that they not only make good crops, but also yearly improve their lands, and yet they advocate different systems of rotation of crops, varying in the number of years through which the rotation passes from two to six. Nay more, the same gentleman has at different times on the same land advocated different systems—and still been successful. How is this? Does it prove that rotation is a matter of no importance? Not at all. It only proves that different soils and different situations require different systems—that it would be the height of folly to make all soils and all crops bend to one uniform system—and that even under a bad system, good management and good cultivation may and will produce satisfactory results. Let it be remembered however that the converse of this proposition is not always true. A good system will not always counterbalance bad cultivation and bad management. While having an eye, and a close one too, to the most important, let not the farmer neglect the many smaller matters, which in the aggregate may not the less affect immediate results.

If so much has been written and ably written too, what need of more? perhaps the reader will ask. I readily answer, because the subject is important, and every *fact*, however apparently trifling, drawn from experience, connected with it, is important, and one or two facts I wish to communicate, besides wishing to draw information and advice from others.

In determining on every system of rotation, a few important points must be looked to. Is the principal business of the farm the raising of stock or growing of grain? If the latter, is the land best adapted to the growth of wheat or corn? Is the farm level or hilly? Does the farmer enjoy great facility of getting his products to market, or the reverse? And several other leading matters which will readily suggest themselves.

It is not my object to discuss at this time the best rotation for every possible variety of soil and circumstance, but to call attention to that which I consider best adapted to a grain-growing farm, situated on tide water, adapted better to the growth of corn, but capable of producing very good clover and wheat.

Such generally is my farm, but it is necessary to state that it is very rolling, and that there are 60 acres of land very stiff and totally unfit for producing corn. In fixing on my rotation, I set apart these 60 acres to be divided into two fields to be fallowed alternately for wheat, and to be kept in wheat and clover as long as they remain clear of blue-grass and other pests. The remainder of my farm I could not so readily determine on. When I received it, it had been cultivated for some years on the four-shift system of Arator, fallowing however to a very small extent each year. The portion of the field not fallowed, by lying out so long, became excessively foul with sassafras, locust, wire-grass, and innumerable pests of the vegetable kingdom, so that preparing it for the next corn crop was an Herculean task. I soon found that would not do; that most of my yearly labor was expended in conquering a growth of pests only to be again repeated when the land came again into cultivation. But what to do? There was the rub. I knew that my land, with my indifferent management and limited means of manuring, could never stand the scourging system pursued with such eminent success on the fine wheat soils of Westover and Shirley, and under the superior management of Messrs. Selden and Carter. I could not adopt the three-field rotation of corn, wheat and clover; because my land was so hilly, that a hoe crop every third year would soon cover it with washes and gullies. Besides, I was fully convinced of the great improvement to be derived from summer-fallowing, the importance of having some work of this kind for the horses to do at this otherwise idle season, and the great advantage of having one field ready when the 10th of October (my seed-time) came. I confess that having, as I mentioned above, 30 acres to fallow each year, I was about this time much tempted to yield to the arguments of Mr. Harrison, Mr. Tabb and Mr. Roy, to whose interesting communications I would refer the reader, but was prevented by the hilliness and rolling nature of my land. I have no sort of doubt that the system which they so ably recommend is the one best adapted to most of lower Virginia, which is generally level and better fitted for corn than for wheat culture. The consideration that corn is a very certain, and wheat a very uncertain crop, deservedly had much weight.

Being driven from the three and also from the four-field rotation, I next very naturally turned my attention to a five-field system. I was the more reconciled to this, because about this time I heard that Mr. Harrison was thinking of abandoning his favorite three-field for the four-field system, and that Messrs. Selden and Carter were meditating a change from their boasted four-field rotation to one of five fields. These gentlemen are our Cokes and Blackstones, in matters of agriculture, on lower James river, and I must be excused for adducing them as *authority* so often.

A five-field system was then the thing. The best arrangement for five fields of which I had heard was that pursued successfully by Mr. Wickham, viz., corn, wheat, clover, wheat, clover. But I learned from Mr. Harrison that under this arrangement my farm would become foul—one of the principal objects I had in view in abandoning my old system (Arator's four-field.) A second objection was that the clover, on the authority of Mr. Selden, would most likely fail after the fallow crop of wheat. A third and very serious one was that if the crop of clover preceding the corn was closely grazed it would be rendering the earth close and compact, which was much to be re-

gretted for corn, and would be bringing the three grain crops and one year of grazing all in close and rapid succession. On the other hand, not to graze would be to insure a fine crop of vegetable pests; they in turn furnishing a nest to breed, and a harbor to protect, an equal number of animal ones. I shall revert to this system; it has much to recommend it. "Rivanna," a writer in the 8th volume of the Farmers' Register, considers it the beau-ideal of a system of rotation. By the way, if his eye falls on these desultory remarks, will he inform us whether his opinion is the result of actual observation and experience, or a deduction from theoretical principles? Dr. Braxton too recommends it as highly improving after several years' experience.

At this juncture there appeared in the volume of the Register for 1839, several essays (I judged) by the editor, in which he discussed the manuring and cleansing of lands by their own growth, and the application of the principles of the rotation of crops. A suggestion there met with made me hope that I could adopt the four-field and fallow rotation, with all its great benefits, without any detriment to the land; which was, that by sowing peas broadcast amongst the corn at the time of laying it by, an excellent pea fallow might be had the same fall. Such a pea crop would not only be alternating the *kinds* of crop, but would be furnishing enriching matter to the land for its improvement. I tried it; but failed so completely on the first trial that I was never after induced to repeat it. Yet such practice is highly recommended, and Mr. Braxton, in his valuable article on rotation, in vol. viii., if I mistake not, says that he has practised sowing peas in this way, and with success. I also tried sowing buckwheat in the same way, but with no better result. All would not do. To the five-field rotation I was driven. Having thus unconditionally made up my mind to adopt five fields, I was anxious to adopt the plan most improving, and which also would yield most immediate profit. I adopted a system suggested in one of the above mentioned essays, viz.:

First year, corn.
Second do. peas, fallowed in fall for wheat.
Third do. wheat.
Fourth, do. clover.
Fifth do. wheat.

And wishing to derive every benefit, I also adopted the recommendation of sowing the corn field in rye in the fall; the rye to be turned under next spring while in flower for peas. I did not derive the slightest benefit from the rye. If the month of May happened to be dry, I found it very laborious ploughing the land in rye, even when other land did not appear very hard; and I soon became convinced that if any benefit did accrue to the land from the rye, it was not sufficient to remunerate me for expense of seed and ploughing. I have since seen, in one of Mr. Carter's papers, that he came to the same conclusion with regard to oats turned in for improvement, from an experiment actually made. I also substituted, when ill-supplied with seed-peas, buckwheat for the peas. But I never found any benefit from it. Nor ought it to have been expected. Both rye and buckwheat are narrow-leaved, fibrous-rooted, grain-producing plants, and no doubt must draw nearly as much from, as they can return to, the earth.

My rotation now stands—1st year corn, 2d peas, 3d wheat, 4th clover partially grazed, (late,) 5th wheat. About half of the corn land is put in oats and sown in clover, leaving only half for peas and wheat. That put in oats of course remains two years in clover, and, with the help of a standing pasture, supports the stock, till time to glean the wheat fields, both of which are grazed moderately. In fact I have come to the conclusion, that light or corn land, like mine, to improve *progressively*, must be grazed. There might be faster improvement, for a short time, without the hoof, but it would sooner cease to progress.

To my present plan there are strong objections, which I will briefly enumerate. 1st, the expense and labor of the additional ploughing for peas, when compared with the sowing of clover in the five-field rotation of Mr. Wickham. 2d, clover is not apt to succeed very well after the wheat on the pea fallow. Whether the peas render the land too porous, or whether the rank growth of wheat which succeeds a rank growth of peas smothers the clover, I am unable to say. A third objection is, that the oat field, being followed two years by clover, becomes very foul. And two years in clover are necessary to bring that portion into rotation with the other half of the field reserved for wheat. I select for the oats the most rolling portion of the corn field, which is thereby subjected to one ploughing less in the rotation than the remainder of the field, and if it becomes more foul, my idea was that it would be less apt to wash; and of the two, foulness or gullies, I greatly preferred the former. But even in this I have been disappointed, for by this arrangement, it will at once be seen that the land intended for oats lies throughout the winter without any vegetable cover, and of course in the worst state for the action of the rains. I believe that if I adopted the five-field system, marked below No. II, and followed the corn by wheat on all the rolling parts and by oats in all the level parts, the whole to be sown in clover and fallowed the following fall twelve months, that it would not only be better, for guarding against washing, but also it would be a more cleansing system, so far at any rate as the oat land is concerned.

I confess that I am now wavering between the two systems and have not yet come to a final determination. If any brother farmer can aid me in my quandary he will receive my warmest thanks. I cannot do with less than five fields; and the question is shall I adhere to my present five field and (pea and clover) fallow rotation, or shall I adopt Mr. Wickham's system of five-fields, two of which are in clover. To compare them better I will place them in juxtaposition.

I. Pea & clover fields.	*II. Two clover fields.*
1st year corn.	1. corn.
2d " half in peas, and half in oats.	2. half in wheat and half in oats.
3d " half in wheat & half in clover.	3. clover.
4th " clover.	4. wheat.
5th " wheat.	5. clover grazed.

I think both capital rotations, as free from objections as any rotation contained in 5 years or less time can be, but they still have their objections, some of which I have stated above with regard to each one. Here I would only ask a single question. Would as much wheat be made on the 2d as on the 1st plan? A reduction of the

profits of each to figures I am unable to give, never having tried one of them.

I am aware of a third scheme of a five-field rotation recommended and adopted by Mr. Carter. But in my humble judgment it is inferior to either of the above; and in this opinion I am supported by Mr. Braxton, and by a writer over the signature of R. in vol. viii.

In the above remarks, I have frequently called to my aid the authority of many of your ablest correspondents, and in doing so it is hoped that the opinions of none have been misrepresented. If otherwise, I hope to be set right; and cannot conclude without remarking that if this communication has no other merit, it has at least that of presenting in one view a long list of Virginia's noblest sons and benefactors. *Benefactors*, I say, for by regenerating her soil, they have done her more service, than the whole host of her politicans for the last forty years. N.

February, 1842.

ON THE FARMING OF THE REV. JESSE H. TURNER.

To the Editor of the Farmers' Register.

It is a sort of adage that there are "secrets in all professions." I believe, however, that there is an exception to this as there is to most general rules. The profession of farming is an exception. By common consent, the experience of every farmer is common property with his brother farmers, and it is generally conceded that every farmer has a right to call on others for such information as he wishes, without the fear of refusal. With these remarks I would take the liberty of making an appeal (and I hope not in vain) to my old friend, the Rev. Jesse H. Turner. In a recent visit to his farm I was delighted at the neatness, order, system and high state of fertility which he had effected in a few years. But that which most of all is to be admired and is the best test of good farming, is that he makes his farm very profitable. Now I hope Mr. Turner will excuse the call which I make upon him, and gratify me as well as do the public a service by giving a general detail of his system and management. I hope he will give us a series of essays embracing his *whole* system, rotations, corn-culture, grass-culture, manuring, fallow, &c.

W. J. Dupuy.

[We have, long ago as well as recently, made similar requests of Mr. Turner, and now heartily second this public call made on him by our correspondent. We know of no one whose practice has been more successful, or profitable, in his situation, of a farmer near enough to a city to use bought manure. Still, we think that he has so far missed one of the greatest means to aid and fix his other manurings of his fields, in neglecting to apply lime. Without this, or some other calcareous manure, on a naturally poor soil, all putrescent manures are but of transient effect, and are rapidly lost. Mr. Turner has made unquestionable and very large agricultural profits, by continually renewing large supplies of purchased putrescent manures, added to his own farm supply. But if he had made his soil calcareous, it would render the other manures permanent, and also make the crops better and more certain, than can be done by any possible amount of putrescent manure alone. While fully believing that both the enriching and the profits of Mr. Turner's farm have been very considerable and unusual, we must still also believe that there is yet wanting, in the use of lime, the "one thing needful," to render his improvements permanent, and his farming far more perfect and profitable.—Ed. F. R.]

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EDMUND RUFFIN, EDITOR AND PROPRIETOR.

SANDY POINT ESTATE.—NO. V.

To the Editor of the Farmers' Register.

Sandy Point, 18*th February*, 1842.

The following communication will present a general summary of the farming operations, on this estate for the year 1841, (exclusive of those which may have been noted in former numbers,) and would have been forwarded to you ere now, had not a protracted indisposition and other causes induced delay.

The 1st of January, 1841, found us with a very considerable proportion of the corn crop of 1840 yet out in the field, being prevented from hauling off the land sown in wheat, by the continued wet weather, and consequent soft state of the ground; nor was all got in till the 15th of February, when the last loads were got up, all in good and safe condition.

Fallowing operations for the corn crop of this year (1841) were fully two-thirds executed prior to the 15th of December preceding, and it proved fortunate that we were so far in advance, for the unprecedented wet winter effectually put a stop to all such operations. Nor were we again able to resume fallowing earlier than the 22d of February. The general condition of the ground then being wet and heavy, we were only enabled to plough on drier portions of corn ground, and that intended for oats.

At intervals, during the last week of February and 1st day of March, 24 bushels of clover seed were sown amongst wheat; the ground in good condition for receiving the seed, which was sown without receiving either a subsequent harrowing or rolling, and has generally succeeded well. One gallon of seed was sown per acre, and from the apparent abundance of plants has proved to have been an abundant supply. Not more than 30 acres of the land thus sown in clover had been rendered calcareous by a preceding application of lime or marl. The larger proportion was sown on a neutral soil, a portion of which might be considered rich; but much the greater part of only medium quality as to fertility, and a few acres of a lighter soil, decidedly poor. On this latter the stand of plants, as was anticipated, is very sparse, on the other and larger portion of neutral soil, the general stand is pretty good, though greatly inferior to that sown on land of an exactly similar nature, and which had received the benefit of a dressing of either lime or marl, on which the plants are not only thickly set, but now present a luxuriant appearance.

Oat sowing was commenced on the 2d of March, but, in consequence of delays from frequent rains, was not completed until the 30th of the month. On corn ground of the preceding year there were sown 220 bushels, and 113 on a weed and clover fallow, intended for ploughing under at the proper season, as a preparatory green manuring for wheat. The result of this crop was extremely indifferent. Oats suffered from drought; straw was generally very short; and the grain was also indifferent—the whole being little short of an entire failure. The seed originally was not pure, being a mixture of the common and ruffle oats, not so from choice, but from carelessness in storing past seed, or by some other means allowing them to become mixed. The sowing of them in this mixed condition, for two or more years, resulted in both varieties becoming degenerate and unprofitable, so much so as to induce an entire change of seed, and that to the common in preference to the ruffle oat.

Fallowing of corn land was completed on the 2d of April, and even at that late season with difficulty; a wetter, or more harassing season for general farm operations I have never encountered. Planting of corn was begun on the drier and lighter portions of ground on the 27th of April, and, including some delays from rains, was finished on the fourth of May. The extent of ground planted, as stated in a former communication, being about 603 acres. The whole had been carefully fallowed by three-horse ploughs. The larger proportion of the several fields being of good soil, the growth of clover and weeds was generally heavy. About 130 acres of the whole had received a dressing of lime or marl, the greater proportion of the latter immediately before planting. A small portion had been limed some years previous. After fallowing, the whole was well and finely harrowed, and where judged necessary was re-fallowed, and again harrowed. All being thus considered in good condition for receiving the seed, so far as being in good tilth could be beneficial. Where not liable to be injured by surface or other water, the corn was planted in checks, and cultivated in both ways; but where liable to become wet, particularly in stiffer bottoms, or sufficiently sloping to be washed by heavy rains, drill planting was adopted. Markers previously passed over the fields, laying off or marking the rows; the seed furrows were then opened by one-horse mould-board ploughs, the planters following after at a convenient distance, dropping the corn and slightly covering it with the foot, and heavy harrows following after and finishing the operation. By this mode, in good weather and free from interruption, our average planting per day is equal to 150 acres, and the fields are left in neat and good condition. The harrowing of the land after corn planting I consider a very desirable object; the surface of the ground is left in the cleanest and best possible condition, and if properly executed is little inferior to a course of ploughing; and it also proves the best defence against the attacks of crows that I have yet known. A small portion of bottom land was left without the harrow passing over after planting. On this spot the crows picked up nearly every hill, but where harrowed very few hills were missing from this cause. With the exception of some of the stiffer bottoms of the best portion of the fields the general crop started well. On about 125 acres the cut-worm unfortunately soon commenced its ravages, and on which it was with the greatest possible difficulty that corn could at all be got to stand. Much of this

land was, subsequent to its original and also first replanting, twice ploughed up entirely, and replanted; and then recourse had to be had to setting out plants from other portions of the fields. After this pest had in some measure desisted from its inroads, the bud-worm commenced operations, and likewise did no little damage; so much so that on the 22d of July, when the culture of the corn crop terminated, these portions of the fields did not afford the prospect of yielding any crop. Rains occurring early in August did much to give it a start, when it improved much more rapidly than I could have anticipated. The results, however, though better than expected, were little if any over one third of a crop, and that from the richest portions of the fields, with this exception, a heavy one. It must be admitted, it is considered that the general return will prove a fair average crop, but which cannot as yet be accurately ascertained. The course of culture pursued in this crop of corn was first throwing a furrow from each side of the corn with one-horse mould-board ploughs, and breaking the balks with trowel hoes. The second and cross ploughing was altogether with trowel hoes, the small, or as it is here designated the X trowel hoes, going next to the corn. Weeding hoes following after this ploughing as speedily as possible. Corn, with the exception of ditch banks and rich headlands, thinned to one stalk to a hill. The ploughs having finished the second ploughing, one-horse mould-board ploughs again run on each side of the corn, throwing the furrow-slice to the plants, the trowel hoes again in the balks. This course also finished, the whole is again gone over with the trowel hoes—seldom completed before wheat harvest interrupts; after which all grassy and foul spots receive another stirring with trowel hoes, followed also by the weeding hoes. Thus the larger proportion of the crop received five ploughings, performed as carefully as possible; and when laid by, the fields were in clean and good condition.

On the 5th of June one half of the barrel of poudrette which you kindly presented for experiment was applied immediately after the first hoeing (received too late for an earlier application) to a portion of the corn-field, where no marl or lime had been applied, selecting each alternate two rows of fifty hills each. A portion of these rows had a quarter of a pint of poudrette applied to each hill, and another portion had half a pint applied in a similar manner; and on June 15th, the remaining half of the barrel was applied on a portion of the field recently marled, selecting each alternate two rows as above, giving to each hill half a pint; and after careful observation throughout the season, I could not discover that any benefit resulted from the application in either case. Was the application properly made?

Very little of the blade fodder was pulled from this crop of corn, probably not more than 12,000 lbs., having been able, at the proper season, to cure a considerable portion of good clover hay, which, with the aid of cut and salted shucks for our horses and mules during the long winter nights, and on which they do well, will be sufficient for our consumption. Top fodder was cut from off little more than one third of the crop at a season sufficiently advanced not seriously to injure the corn.

On the 14th and 15th of June, 68 bushels of black-eyed peas were sown on a principally weed fallow; covering ploughed under of good growth generally, and in some places heavy. These were sown broadcast, and covered by one-horse ploughs, intended as a preparatory green manuring for wheat. The subsequent growth of peas proved to be good, causing considerable difficulty in ploughing them under. The results of this mode of manuring on the now growing wheat crop are looked forward to with considerable interest. On the 22d and some following days of July, a crop of oats on adjoining land was also ploughed under as a preparatory manuring for wheat. Crop of oats, unless on headlands of ditch margins, very indifferent; the second or volunteer growth, however, proved excellent, and was again ploughed under at the time of sowing the wheat. The soil on which both oats and peas were thus sown and treated was uniform; and to a portion of both, side by side, marl was applied in the month of September, a favorable opportunity will thus be presented of testing the comparative value of oats and peas as a green manuring.

Fallowing clover lay for wheat was begun on the 25th of July, and finished on the 20th of September, amounting in all, pea and oat fallow inclusive, to as nearly as can be judged not less than 525 acres. The whole performed with three-horse ploughs. On some portions of the fields thus fallowed occasional difficulties were experienced from the ground becoming hard and dry; but not to any injurious extent. The whole having been performed generally well, and being carefully levelled by heavy harrows, was left in good condition for receiving the seed; sowing of which was commenced on fallowed land on the 1st of October. Rain occurred on the evening of the 2d, and but slight progress was made until the 6th, when weather and ground both became more favorable for this important operation. Another delay occurred from the same cause from the 10th to the 14th, from which time the weather continued remarkably favorable for wheat sowing, until its completion on the 8th of November. On fallowed land there was sown 918¾ bushels of red or purple straw wheat, and on corn land 68 bushels of purple straw, 553¼ bushels of white Turkey, and 5 bushels of rock wheat, the whole being equal to 1545 bushels. All of the wheat was covered with two-horse mould-board ploughs, both on fallow and corn land. The heavy growth of grass on much of the latter rendered ploughing difficult and tedious. Heavy harrows followed once or oftener, and these again by hand-hoes. Water furrows were carefully opened, and the whole left in as good condition for the wheat as could be obtained. The time occupied in sowing and covering was equal to 26 days, or an average per day of 59$\frac{9}{26}$ bushels. The drought which prevailed until the middle of November caused the late sown wheat to vegetate slowly in many places; and had also an evident unfavorable tendency on the earliest sown and most forward wheat, causing much of it to assume a yellow or rather red appearance. So far as could be observed there was no fall attack of the Hessian fly. Up to this date, the unusually mild weather which has prevailed during this winter has caused young wheat to be generally very forward, particularly on fallowed land. I have never

before seen it look better in the month of April; and from this cause I greatly fear that a succeeding season of severe frost might have on it a most injurious if not ruinous tendency. Wheat sown on corn land is much less forward, generally however presenting an appearance not unpromising.

Of putrescent manures there were during the season, chiefly in the early spring months, 2599 loads hauled out: 245 loads of the finest or most rotted manure were applied on corn land in the spring; the residue mostly cow-pen and stable manure, only partially decomposed, was applied as a top-dressing on clover intended for wheat fallow. Every season's practice of this mode of application strengthens my opinion of its being the best and most profitable. The average quantity applied to an acre was 18 loads; each load such as is usually hauled out by six oxen on large carts.

Of calcareous manures there were 41,959 bushels of marl applied during the year. One-third of that quantity was applied in the spring previous to planting corn; the other two-thirds at intervals during the summer and fall months, on clover, pea and oat fallows, intended for wheat; the average quantity per acre being 170 bushels of marl containing 60 per cent. of lime. In all about 246 acres have been marled during the year, in addition to which 350 hogsheads of shells were burned in the spring and applied to land afterwards planted in corn, at the rate of from 90 to 120 bushels of lime per acre. A 20-acre lot had one half of it a dressing of lime at the rate of 120 bushels per acre, and the other half a dressing of marl at the rate of 200 bushels per acre, of same quality as above stated. A single corn row formed the dividing line between the two applications. The soil was of uniform texture and quality. The progress of the growth of the corn on both was narrowly watched during the season; little if any difference could be discovered. The crop on both was good, and if any difference did exist, I would say that it was in favor of the marl. Other individuals who had seen the crop expressed the same opinion. The entire 20 acres on which these applications were made are now in wheat, which crop may perhaps more directly test the relative value of the two applications.

In former communications I have noticed the happy effects which had regularly attended each application of lime or marl on this estate, and will now only observe farther, that time and more extensive applications strengthen the favorable opinions heretofore expressed.

The end of the year again found us with a considerable portion of corn still exposed in the fields sown in wheat. Not less than 525 to 550 acres of land have been fallowed towards crops of 1842, of chiefly clover and weed lay; and altogether operations are generally in a favorable state of forwardness, of which and their results more may be said in a subsequent communication.

A. Nicol.

THE CUT WORM.

From the American Farmer.

Mr. Editor—This is the popular name of a grub or worm, very destructive to corn, cabbage plants, potatoes, clover, &c. I have in vain searched through all the volumes of the "American Farmer," and other agricultural journals for a history of this insect. It has by some been intimated that a *black bug*, about an inch in length, of a quick and lively motion, was the parent of the cut-worm; but nothing like a rational history of its changes and habits has ever been given, so far as I have been able to ascertain. A very slight knowledge of entomology would be sufficient to convince any one that a "*black bug*" would not be the parent of a larva of the caterpillar kind, such as is the cut-worm. We are then to seek among the genus papilla or phalæna for its parent.

It is somewhat remarkable that the history of an insect so destructive to the principal crop of the farmer as is the cut-worm should be so shrouded in darkness or veiled in obscurity. Having suffered myself, and having long witnessed the sufferings of others, by the ravages of this destructive insect, I have for some years past made its history a subject of study and observation; and if I shall be so fortunate as to cast such light upon it as shall be useful to the agricultural community, for which I have a high regard, I shall consider myself amply rewarded.

In the year 1838, I had a short conversation with E. P. Roberts, esq., then editor of the "Farmer and Gardener," on this subject, and informed him that I was prosecuting some inquiries on the history of the cut-worm; at his request I promised him, when they were completed, to communicate them for that journal. Until last year they were not satisfactorily accomplished. On the 20th of July, 1841, I took from the root of a cabbage plant a full grown cut-worm, and put it into a glass jar with a little fresh earth, so that I might observe the changes it underwent. On the 30th it had become a chrysalis of a brown mahogany color, and on the 15th of August it underwent the last metamorphosis and become a moth, of a grayish hue, and of about one inch in length. These operations and changes were carefully noted in my farming and gardening diary, from which the above extract is made.

Being then possessed of the parent moth, I was enabled to fix on the order, genus and species of the insect; which are the following:

Phalæna—*moth*, of the order lepidoptera; flight nocturnal of the assortment noctuæ, wings incumbent, antennæ setaceous, of a grayish color, clouded and variegated, about one inch in length. It changes to a chrysalis in July, and the moth appears in August. It lays concealed in the shade of green herbage in the day time, devotes a few nights to love and sexual embraces, deposites its ova on the stems of green and growing plants near the roots; when, having performed these offices appointed by nature for the propagation of its progeny—it dies. The eggs hatch in a few days, the young brood commence their ravages on the green clover and attain about half their growth the same season, and lie buried at the root in a torpid state during winter. As the warmth of spring reanimates them, they become ready for

the corn crop, or the first green-plant that is presented to their gluttonous appetite.

It is entirely gratuitous to say that fall or winter ploughing will destroy them. I have found a cut-worm, nearly full grown, early in March, at the root of ripple grass (plantago.) After the extract, which I shall presently make from good authority, it is to be hoped that the destruction of the cut-worm will never again be mentioned as an apology for the pernicious practice of fall or winter ploughing—a practice tending equally to impoverish the soil with that of leaving it exposed, naked, to the scorching rays of a vertical sun.

In the 3d vol. of the old American Farmer, page 94, will be found the result of an experiment by Dabney Minor. He had a field of 110 acres of heavy clover stubble, 95 of which he had ploughed with two yoke of oxen to a plough in the fall of 1820. Ten of the 15 he had listed the next spring. Five he left standing in clover. The whole field thus prepared, with the exception of the five acres in clover, was planted in corn about the middle of April. "The worms commenced their depredations with the coming up of the corn. A large portion of the corn on that part of the field ploughed in the fall has been destroyed, and the remainder so crippled as to render it doubtful whether it will recover. The corn in the ten acres of the balk land, together with the clover in the balks, has been destroyed root and branch, and the five acres of clover adjoining have shared the same fate. I have never seen an instance of so entire and complete destruction. I have on this day, May 22d, reploughed and replanted the whole piece, with however but little hope of succeeding in a crop from it, for the worms are as numerous as ever." After this, let no one advocate fall or winter ploughing—*to kill the cut-worm!*

The only method to prevent this scourge is to turn under the clover crop early in August, before the eggs are deposited; and if this were done the *second* year after the clover is sown, it would be the better method, as well for this purpose as to prevent the blue grass from getting too much ahead. The rotation of crops should be changed, so as to let corn follow the wheat crop.

A knowledge of the history and habits of insects is useful to the farmer, that he may be the better enabled to counteract their pernicious influence. Next to the Hessian fly, the cut-worm is the most destructive to the growing crops. When clover stands three years they must destroy more than half the crop of the third year; but as this does not come so immediately under his cognizance, it is overlooked by the farmer.

The flight of the cut-worm moths is nocturnal, and they are attracted by fire. By kindling fires, a few nights in August, in and about clover fields, great numbers may be thus destroyed; and it may be observed, that for every moth destroyed at that time we prevent the probable increase of some hundreds of their progeny.

Last fall I spread on a clover field, intended for corn next spring, about 20 bushels of slacked lime to the acre, in the full belief that it will destroy the cut-worm; if I should be disappointed in this expectation, it will not be labor lost, as the land will be improved by the lime sufficiently to pay the expense.

The corn crop is so important to the farmer that he should not spare any reasonable exertion to ensure a full one. Replanted corn never comes to much, and it is not only a loss of time but perplexing to have our crop thus mutilated.

The rotation that appears most likely to succeed is the following—wheat, corn, oats, wheat, clover, clover. This will bring two fields each in wheat, one in corn, one in oats, and two in clover. This would serve for the six-field system. For the five field the following: wheat, corn, wheat, clover, clover. Either, by letting the corn-crop follow wheat, will be found a sure protection from the cut-worm, without fall ploughing. It is the clover which serves as a harbor and nursery for the cut-worm, as well as other insects; and as before observed, it should not be permitted to remain longer than two years. W. L. Horton.

Wood Lawn, Feb. 16, 1842.

REMARKS AND INQUIRIES ON MANURES.

To the Editor of the Farmers' Register.

I have just read, in your January number, an elaborate "essay on the making, the preserving, and the applying of manures." This is evidently from the pen of a sensible writer; but to farmers, who like myself are interested in acquiring practical agricultural information, it is desirable to know how far the writer's theory has been sustained by his practice. For my own instruction, then, I beg leave respectfully to inquire of him as to portions of the system he recommends:—

First, what is the number of his horned cattle; what number of acres he annually manures by cow-penning, (commonly so called,) and whether an equal degree of fertility is imparted to the land by this mode as by manuring from the stables and farm-pen in the customary manner?

Second, as to hogs. Can farmers generally afford to keep them up in the way described by the writer, and do they thrive through our long, hot and dry summers in that state of confinement? What amount of labor is necessary to collect the materials for them to work up into manure, and what is the comparative value of that manure, mixed, as it must be, with such immense proportions of mud, dirt and litter? What will a farmer's pork cost him, raised in this way, out of the immediate vicinity of a market?

In my county, reapers and mowers are worth one dollar per day. At this rate what will it cost, per acre, to cut down the weeds, &c., for litter, as recommended; and is not this practice injurious to the land from which they are taken?

The writer of the essay is, I take it for granted, an amateur farmer, and consequently he will not be offended by these questions, which have been suggested to my mind on reading it. They are put in a spirit of perfect respect for the talents and motives of the author.

Feb. 21, 1842. A Young Farmer.

TO KILL LICE ON COWS, HORSES OR HOGS.

From the Central New York Farmer.

Take the water in which potatoes have been boiled, rub it all over the skin. The lice will be dead within two hours, and never will multiply again. I have used ten kinds of the strongest

poison to kill lice all with effect, but none so perfect as this. M. T.

Ellisburg, Jefferson co., Dec. 30, 1841.

OF THE IMPROVEMENT OF RACES.

From Lindley's Horticulture.

What has been stated in the preceding chapter, concerning the preservation of the races of domesticated plants, is in some measure applicable to their improvement, because the very means employed to preserve those peculiarities of habit which render them valuable, will, from time to time, be the cause of still more valuable qualities making their appearance. There are, however, other points of great importance on which the gardener has dependence.

A fixed improvement in the quality of the produce of a plant can only be obtained in one of two ways; either *directly*, by accidental variations in itself, or *indirectly*, by the process of muling.

Direct alterations in the quality of seedling plants often occur from no apparent cause, just as those accidental changes, called "sports," in the color or form of the leaves, flowers, or fruit, of one single branch of a tree, occasionally break out, we know not why. Of these things, physiology can give no account; but it is known that, when such sports appear, they indicate a permanent constitutional change in the action of the limb thus affected, which changes may be sometimes perpetuated by seed, and always by propagation of the limb itself, when propagation is practicable. It is in this way that many of our fruits have probably, and several of the Chinese chrysanthemums have certainly, been obtained. It was apparently thus that the nectarine emanated from the peach. It is possible that many new forms of shrubs might be procured by keeping these facts in view, and that climbers might be deprived of their climbing habits; for it is known that the handsome evergreen bush called the tree ivy, which grows erect, with scarcely the least tendency to climb, has been procured by propagating the fruit-bearing branches of trees of considerable age.

But we are by no means destitute of the power of procuring, with considerable certainty, improved varieties, by an application to practice of physiological principles. In the last chapter has been shown the importance of securing the production of seed by plants in the most healthy state possible, because a robust parent is likely to afford a progeny of similar habits to itself. In annuals, however, this is apparently restrained within narrower limits than in woody plants, from the great difficulty of fixing a new peculiarity in the former, and the facility with which it may be effected in the latter case, by means of buds, cuttings, grafts, and similar modes of propagation. The great object of the scientific gardener who desires to improve the varieties of plants upon principle will be, then, by artificial means, to bring the parent from which seed is to be saved as near as possible to that state at which he desires the seedling to arrive.

It is well known that the abstraction of fruit and flowers augments the vigor of the branches, or of the parts connected with them, and that the removal from the former of any part which takes up a portion of the food employed in the support of the flowers increases their efficiency. Thus those varieties of the potato, which will neither flower nor fruit otherwise, may be made to do both by stopping the developement of tubers; and, on the other hand, the size and weight of the tubers themselves are increased by preventing the formation of flowers and fruit. The course, then, to take, in obtaining the largest possible tubers in a new variety of the potato, would be, in the first place, to effect that end temporarily, but during several successive seasons, by abstracting all the flowers and fruit, and by such other means as may suggest themselves; and then to obtain the most perfect seed possible by a destruction of the tubers during the season when seed is finally to be saved. Mr. Knight found, in raising new varieties of the peach, that, when one stone contained two seeds, the plants these afforded were inferior to others. The largest seeds, obtained from the finest fruit, and from that which ripens most perfectly and most early, should always be selected (*Hort. Trans.*, i. 39); and, in his incessant efforts to obtain new varieties of fruit of other genera, he had reason to conclude that the trees, from blossoms and seeds of which it is proposed to propagate, should have grown at least two years in mould of the best quality; that during that period they should not be allowed to exhaust themselves by bearing any considerable crop of fruit; and that the wood of the preceding year should be thoroughly ripened (by artificial heat when necessary) at an early period in the autumn; and, if early maturity in the fruit of the new seedling plant is required, that the fruit, within which the seed grows, should be made to acquire maturity within as short a period as is consistent with its attaining its full size and perfect flavor. Those qualities ought also to be sought in the parent fruits, which are desired in the offspring; and he found that the most perfect and vigorous progeny was obtained, of plants as of animals, when the male and female parent were not closely related to each other. (See the *Horticultural Transactions*, i. 165.)

There are no processes known to the cultivator so efficacious in producing new varieties as that adverted to in the last paragraph, that is to say, muling or cross breeding; and it is to these operations, more than to any thing else, that we owe the beauty and excellence of most of our garden productions; more, however, I think, to cross breeding than to muling. It was entirely by the first of these processes that have been so greatly multiplied and improved our fruits for the dessert, and the gay flowers that adorn our gardens. The pelargonium, the calceolaria, the dahlia, the verbena, and a thousand others—what would they be but simple wild flowers, without the power of man exercised in this way? "To the cultivators of ornamental plants," says Mr. Herbert,* "the facility of raising hybrid varieties affords an endless source of interest and amusement. He sees in the several species of

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* See much the most valuable and practical account of cross breeding and muling which has been yet published in regard to horticulture, in the *Amaryllidaceæ* of the Hon. and Rev. W. Herbert, p. 335, et seq.

each genus that he possesses the materials with which he must work, and he considers in what manner he can blend them to the best advantage, looking to the several gifts in which each excels, whether of hardiness to endure our seasons, of brilliancy in its colors, of delicacy in its markings, of fragrance or stature, or profusion of blossom; and he may anticipate, with tolerable accuracy, the probable aspect of the intermediate plant which he is permitted to create; for that term may be figuratively applied to the introduction into the world of a natural form which has probably never before existed in it. In constitution the mixed offspring appears to partake of the habits of both parents; that is to say, it will be less hardy than the one of its parents which bears the greatest exposure, and not so delicate as the other; but, if one of the parents is quite hardy, and the other not quite able to support our winters, the probability is, that the offspring will support them, though it may suffer from a very unusual depression of the thermometer, or excess of moisture, which would not destroy its hardier parent."

In the many successful attempts made by Mr. Knight to improve the quality of fruit trees by raising new varieties, his method was to obtain crossbreds by fertilizing the stigma of one variety of known habits with the pollen of another also of known habits. But, in doing this, his experiments were not conducted at random, and without due consideration; on the contrary, we learn from himself that he was very careful in selecting the parents from which his crossbreds were obtained. He found that the general opinion, that the offspring of crossbred plants as well as crossbred animals usually presents great irregularity of character, is unfounded; and that if a male of permanent habits, and of course not crossbred, be selected, that will completely overrule the disposition to sport, "the permanent character always controlling and prevailing over the variable." He tells us that he usually propagated from the seeds of such varieties as are sufficiently hardy to bear and ripen their fruit, even in unfavorable seasons and situations, without the protection of a wall, because, in many experiments made with a view to ascertaining the comparative influence of the male and female on their offspring, he had observed in fruits, with few exceptions, a strong prevalence of the constitution and habits of the female parent. Unfortunately, however, this is precisely the reverse of the result at which Mr. Herbert has arrived in the very great number of experiments performed by himself on that subject, he believing that the male parent generally influences the character of the foliage, and the female that of the flowers (*Amaryllidaceæ*, p. 348, 377); and although it does appear to me that, in the majority of cases, Mr. Herbert's opinion is the more correct of the two, yet I fear there is too little certainty in the results of hybridizing to justify the establishment of any axiom upon the subject.

This power of muling, properly so called, is confined within very narrow limits, and can hardly be said to exist at all between species of different genera, unless under that name are comprehended some of the spurious creations of inconsiderate botanists. There are, indeed, many cases of species very closely allied to each other which it is either impossible to mule, or so difficult that no one has yet succeeded in effecting it. Mr. Knight never could make the Morello breed with the common cherry. I have in vain endeavored to mule the gooseberry and currant, and we do not possess any garden production known to have been produced between the apple and the pear, or the blackberry and the raspberry, any of which might have been expected to intermix. As to mules obtained between plants of distinct genera, we have, no doubt, upon record, some experiments said to have been performed successfully in crossing a thorn-apple with tobacco, the pea with the bean, the cabbage with the horse-radish, and so on; but Mr. Herbert regards these cases, and I think with great reason, as apocryphal, and not to be relied on; the fact being, as he truly states, "that in this country, where the passion for horticulture is great, and the attempts to produce hybrid intermixtures have been very extensive during the last fifteen years, not one truly bigeneric mule has been seen."

On the other hand, cross breeding will take place quite as readily among plants as among animals, and it is difficult to estimate the alteration which this process has really produced, although unperceived by us, in the amelioration and alteration of long-cultivated plants. We cannot reasonably doubt that a process so simple as that of dusting the stigma of one plant with the pollen of another, which must be continually happening in our gardens, either through the agency of insects or the currents in the air, and which, where it takes place between two varieties allied to each other, must necessarily produce a cross,—we cannot suppose, I say, that this occurs in our crowded gardens and orchards at that time only when we perform it artificially.

The operation itself, although so simple, consisting in nothing more than applying the pollen of one plant to the stigma of another, nevertheless requires to be guarded by some precautions. In the first place, it is requisite that the flower whose stigma is to be fertilized should be deprived of its own anthers before they burst, otherwise the stigma will be self-impregnated, and although superfœtation is not, by any means, impossible, yet it is not very likely to occur. Then, again, the application of the stranger pollen should be made at the time when the stigma is covered with its natural mucus; if not, the pollen will not act, either in consequence of the necessary lubrification of itself being withheld, from the stigma being too young, or because the stigma, from age, has lost its power of receiving the action of the pollen. Neither should the stigma be in any way injured after fertilization has apparently taken place. The art of fertilization consists in the emission, by the pollen, of certain tubes of miscroscopical tenuity, which pass down the style, and eventually reach the young seed, with which they come in contact; and, unless this contact takes place, fertilization misses. Now the transmission of the pollen tubes from the stigma to the ovule, through the solid style, is often very slow, sometimes occupying as much as a month or six weeks, as in the mistletoe.

Those who occupy themselves in attempts at improving the quality of cultivated plants should be aware of this: namely, that the real quality of either the fruit or the flower of a seedling cannot be ascertained when they are first produced; for it is only as plants advance in age that the secre-

tions necessary for the perfect production of either the one or the other are elaborated. Of this fact, the first produce of the black eagle cherry tree afforded a striking example. A part of it was sent, with other cherries, to the Horticultural Society; and it was then, in the fruit committee, pronounced good for nothing. It was so bad, that Mr. Knight, who raised it, would most certainly have taken off the head of the tree and employed its stem as a stock, but that it had been called the property of one of his children, who sowed the seed which produced it, and who felt very anxious for its preservation. It has now become one of the richest and finest fruits of its species which we possess.

It may be expected that some mention should here be made of double flowers, and of the manner in which they are to be obtained. But I confess myself unable to discover, either in the writings of physiologists, or in the experience of gardeners, or in the nature of plants themselves, any sufficient clue to an explanation of the causes to which their origin may be ascribed. There are, however, several facts apparently connected with the subject, which deserve mention.

A double flower, properly so called,* is one in which the natural production of stamens or pistils is exchanged for petals, or in which the number of the latter is augmented without any disturbance of the former; in other words, it is a case of the loss, on the part of a plant, of the power necessary to develope its leaves in the state of sexual organs. But what causes that loss of power we do not know. It can hardly be a want of sufficient food in the soil; for double flowers (the Narcissus, for instance) become single in very poor soil. On the other hand, it can scarcely be excessive vigor; for no one has ever yet obtained a double flower by promoting the health or energy of a species. When plants are excessively stimulated by unusually warm damp weather at the period of flowering, their flowers in such cases sometimes became monstrous: but the effect of this is to lengthen their axis of growth, and to form true leaves instead of floral organs, just the reverse of what occurs in a truly double flower; the varieties of rosa Gallica often exhibit this kind of change. In damp cloudy summers, some flowers assume the appearance of being double, by the change of their sexual organs into small green leaves, as occurred very generally to Potentilla nepalensis in the summer of 1839, but there was, at the same time, scarcely a trace of any tendency, on the part of those leaves, to assume the color or texture of petals.

There is, evidently, a greater tendency in some flowers to become double than in others, and especially in those having great numbers of stamens or pistils. All our favorite double flowers, hepaticas, pæonies, camellias, anemones, roses, cherries, plums, ranunculuses, belong to this class; and, in proportion as the natural number of stamens diminishes, so do both the disposition to become double, and the beauty of the flowers when altered. The pink and carnation with ten stamens are the handsomest race next to those just mentioned; while the hyacinth, the tulip, the stock, and the wallflower with six stamens, and the auricula and polyanthus with five, form altogether an inferior race, if symmetry of form, and regularity of arrangement in the parts of the flower, are regarded as beauties of the highest order. If the mere circumstance of a plant having but a small number of stamens be a bar to its beauty when made double, how much greater an obstacle to it must be the natural production of unsymmetrical flowers. This occurs in the snap-dragon, which, with a five-lobed corolla, has but four stamens; and the consequence is, that, when it becomes double, the flower is a confused crowd of crumpled petals issuing from the original corolla.

I have heard of attempts to produce double flowers by artificial processes, but I never heard of the smallest success attending such cases, unless the tendency to their production had already manifested itself naturally; as in the stock, which will frequently become single from having been double, in which case its original double character may be recovered. A mode of effecting this has been described by Mr. James Munro (*Gard. Mag.*, xiv. 121). Having a number of single scarlet ten-week stocks, he deprived them of all their flowers as soon as he found that five or six seed-vessels were formed upon each spike, by which means he compelled all the nutritive matter that would have been expended upon the whole flower-spike and its numerous seed-vessels to be concentrated in the small number which he left; and the result, he says, was, that from the seed thus saved he had more than 400 double stocks in one small bed.

There can, I think, be no doubt that, if any original change to a double flower can possibly be effected by art, it will be more likely to occur with respect to those species which have an indefinite number of stamens, where the tendency to this monstrosity already exists. It is not many years since the chryseis (Eschscholtzia) Californica, a polyandrous plant, was introduced to our gardens; and I, at one time, made some attempts to render it double, conceiving it a good subject for experiment on that account, but I had no success; it has, however, accidentally become semi-double in Mrs. Marryat's garden, at Wimbledon; and I entertain no doubt that seed skilfully saved from that plant would present its flowers in a still more double condition.

* What is called a double dahlia is misnamed; and so are all so-called double composite flowers. The appearance of doubling is caused in these plants by a mere alteration of the florets of their disk into the form of florets of the ray; a very different thing from double flowers.

CLOVER AND TIMOTHY--MANURE.

From the Union (Ill.) Agriculturist.

* * * Whilst writing permit me to say, that my experience in raising grass (having cultivated as much as any in this county) amounts to this—clover and timothy mixed will yield one third more hay in lbs. than timothy alone, and more than clover alone, and will stand a drought much better.

Further—Land that is well manured produces double the crop of that which is not. I have tested it in the same field. Rushville prairie appears as rich as any land I have seen in the state, yet *one* load of manure will do as much good as on any land I have ever noticed, however poor. Yours, J. D. MANLOVE.

Rushville, Dec. 21, 1841.

ON GUANO.

(Continued from page 58.)

Of the economical or money value of guano to the English agriculturist.—We come now to consider perhaps the most important question of all, namely, the probable economical value of guano to the English agriculturist.

It may by most persons be considered impossible to arrive at any satisfactory conclusions in regard to this point except by actual experiment—by the trial, that is, of its *precise* effects on different crops and in different soils. This is no doubt the most certain and unexceptionable method of determining its value—but this method requires time, and the concurrence of many individuals. Until these trials are actually made, therefore, we are entitled to inquire of theory how far it can assist us in forming an idea of the absolute money value of this new manure, and we shall be justified in allowing ourselves to be in some measure guided by the answer which theory may give.

I.—Let me first introduce the partial results already arrived at by practical men.

1. Mr. Skirving writes me thus:—"With regard to the relative cost of guano and farm-yard manure, allowing guano to cost 25*s.* per cwt., which I believe is the price at present, it would cost no more to supply 8 cwt. to the acre than 20 tons of manure would; for in this neighborhood in spring-time good horse and cow dung is never under 10*s.* or 12*s.* per ton, besides the heavy carriage and extra expense of application, which on some land would make a great difference."

2. In connexion with his experiment on turnips, above detailed, Mr. Pusey remarks that, although it is impossible to form an opinion from a single experiment, he thinks a farmer who could afford to dress with 20 bushels of bones per acre, at 3*s.* a bushel, might find the guano answer at 20*s.* per cwt.

These two opinions, formed from imperfect or incomplete experiments, are valuable so far as they go; but they can neither as yet be considered a safe guide to the farmer, as to what he may venture to pay for this manure,—nor to the merchant, as to what he may venture to ask for his commodity.

II. But for what price can it be imported? Mr. Darwin informs us that at Arica, in Peru, the nitrate of soda is sold at the ship's side at 14*s.* the 100 lbs., or 15*s.* 6*d* a cwt.; and in this country it used to be sold at 18*s.* or 19*s.* though during the last year it has risen to 26*s.* and 28*s.* a cwt. We may suppose therefore, that 4*s.* or 5*s.* a cwt. would pay all expenses of freight, and leave a handsome profit to the importer. Now, Mr. Winterfeldt * states that the red and dark-gray varieties of the guano, those imported into this country, are worth 2*s.* 3*d.* a cwt. in Peru; in this country, therefore, from 7*s.* to 10*s.* a cwt. ought to be a remunerating price to the merchant, if Mr. Winterfeldt be correct.

It is true that an article is worth to the seller exactly what it will bring in the market, but it is of great importance, not only to the agriculture of the country, but to the speculators themselves, that the price of this commodity should be kept at a reasonable rate. Not only will many more be willing to try it on their farms, if the price be low, but the general demand for it will increase in proportion as the exact experimental farmer shall become satisfied that the use of it is attended with profit to himself.

Every man has a right to a fair return for his own labor, and to an adequate compensation for pecuniary risk; and those persons deserve especial compensation who have hazarded their money in importing a substance which, like guano, may minister to the most vital wants of the country; but those who, having themselves no pecuniary interest in practical farming, are yet desirous, as good citizens, to promote the growth of food as the foundation of national prosperity, may be excused in considering the chance of *great* profits to speculators, as subordinate to the general interests of the agriculture of the country.

III. Let us then advert to theory, and see the *highest* price which, according to its indications, the farmer ought to be called upon to pay for the guano.

We have seen that this substance is a mixture of various chemical compounds. It is a natural mixture; but an artificial mixture may be made which shall more or less completely imitate it. What would such a mixture cost at the present price of the several ingredients of which it consists? The phosphate of lime it contains exists abundantly in bones: the ammonia may be applied either in the form of sulphate of ammonia or of sal ammoniac, both of which are low in price: the common salt and sulphate of soda can be obtained at little cost; and the urea, being so small in quantity, may be either neglected altogether, or may be replaced by a little dried urine or night-soil (Poitevin's manure.) A mixture of this kind, equal in virtue to 4 cwt. of guano, would cost as follows:—

315 lbs. or 7 bushels of bone-dust, at 2*s.* 9*d.*	£0	19	3
100 lbs. of sulphate of ammonia, containing 34 lbs. of ammonia	0	15	0*
5 lbs. of pearl-ash	0	0	10
100 lbs. of common salt	0	2	0
10 lbs. of dry sulphate of soda	0	0	10
530 lbs., equal to 4 cwt. of guano.	£1	17	1½

To these it might be advisable to add 100 lbs. of chalk to aid in gradually converting the sulphate of ammonia into carbonate, in which state it may possibly be more immediately active upon the plant. This, however, is a matter for trial, as I am aware of very beneficial results having been obtained during the past season from the application of sal ammoniac in admixture with other substances, without the presence of chalk.

I consider the above mixture as likely not only to be equally efficient with 4 cwt. of guano, costing at present 5*l.*, but ultimately it may be more so; and this chiefly because in specifying the ingredients no account has been taken of the animal matter present in the bones, though the quantity of gelatine they contain is itself sufficient dur-

* "The red and dark-gray are worth 2*s.* 3*d.* a cwt. The white is sold in the port of Mollendo at 3*s.* 6*d.* a cwt.; and at times, as for instance during the war, it has brought as high a price as 12*s.*"—Winterfeldt.

* At the pleasure of the experimenter, a *portion* of the sulphate of ammonia may be replaced by nitrate of potash, in the proportion of about three of the nitrate to two of the sulphate.

ing its slow decay to yield about 30 lbs. of ammonia to the soil. I have not taken this into account, because the special and immediate action of guano seems to depend upon its containing, like farm-yard manure, ammonia ready formed, and thus prepared to act without delay on the plant to which it is applied. That growth which the ammonia of the sal ammoniac in our mixture is fitted to hasten and provoke, the ammonia which is afterwards slowly evolved from the decaying animal matter will carry forward and help on to maturity. The few pounds of potash in the mixture have been added, not because this substance is always present in the guano, but because it is known that nearly all plants require a certain small quantity of this alkali for the perfect developement of their several parts. Another advantage which will be possessed by the artificial mixture will be, that its constitution will be constant, and may always be calculated upon.

From these theoretical considerations, therefore, we should say that until its virtues are proved to be greater, beyond dispute, than those of the above or similar mixtures, the practical farmer ought not to purchase guano at a higher price than 20s. per cwt., a price which in the opinion of Mr. Pusey the farmer may probably afford to pay—which according to Mr. Winterfeldt would more than remunerate the importer—and below which, according to the chemist, an artificial guano of equal efficacy may be prepared in England, and *from the superabundant produce of our own manufactories.*

Of comparative experiments with guano and other manures.—But the absolute value of guano itself, as well as its relative value compared with other manures, can only be placed beyond dispute by actual and comparative trials of its efficacy in different soils and upon different crops. To be really useful and satisfactory these trials must be made according to some well-digested method, and the comparison must be made with known weights of other substances, the action and money value of which are known, and which from their constitution may be supposed to act on vegetation in a similar way. As I have elsewhere endeavored to draw the attention of practical men to the importance of well-devised and carefully executed experiments in practical agriculture*—not only to the general economy of the art of culture, but also to the establishment of a true theory of its various processes—I shall take the liberty of introducing a few suggestions in regard to the kind of experiments which appear to me most likely to yield results at once economically and theoretically useful.

Among those substances which owe one main part of their beneficial agency on vegetable life to the ammonia they contain or evolve, may be reckoned farm-yard manure, crushed bones, and rape-dust. As the nitrates also act upon plants in a way so far similar to ammonia as to yield nitrogen to them, the nitrates of potash and soda may be included in the list of substances with which it would be desirable to compare the action of the guano. The cost of all these substances is known,—they are all to a certain extent in general use,—and while comparative experiments accurately made by weight and measure would throw light on many obscure points in regard to the action of each of these manures,—the results obtained from every separate plot of ground would serve as so many points of comparison by means of which the absolute and relative value of the guano might be determined.

In the present state of our practical knowledge respecting this substance, it will be pronounced by every one to be desirable that its effect should be tried upon every kind of crop; but the propriety of this course is increased by our knowledge of its chemical constitution. It contains the greater part of the ingredients which are necessary to the growth of almost every variety of crop. It will doubtless prove as efficacious therefore to old pasture-land as to the rye-grass in Mr. Skirving's nursery, and to crops of corn as to Mr. Pusey's turnips; but experience alone can tell us to which it may be applied with profit to the farmer, and from what crops it will afford him the greatest return on a given soil.

I would propose therefore that it should be tried during an entire rotation to replace farm-yard manure and the other substances named, as well as against the mixture above described, which I shall distinguish by the name of *artificial guano.* The mode of making the experiments may be varied at the wish of the practical farmer, but they might be made in a way similar to that represented beneath, each square being a half or quarter acre or other accurately measured plot of land.

20 tons of Farm-yard Manure.	10 tons do. with 10 bushels of Bone-dust.	10 tons do. with 10 cwt. of Rape-dust.	
20 bushels of Bones with Ashes.	20 cwt. of Rape with Ashes.	10 cwt. of Rape with 3 cwt. of Guano.	
6 cwt. of Guano mixed with Chalk or Gypsum.	10 tons of Farm-yard Manure with 3 cwt. of Guano.	10 tons do. with 2 cwt. of Guano.	
6 cwt. of Artificial Guano.	10 tons of Farm-yard Manure with 3 cwt. of Artificial Guano.	10 tons do. with 2 cwt. of Artificial Guano.	

The practical farmer need not be deterred by the formidable array of experiments above suggested. He may try any two or three of them, and his results will be valuable in proportion to

* See a small tract published by Blackwood, under the title of "*Suggestions for experiments in practical agriculture.*"

the accuracy with which his land is measured and his manures and crops weighed. I have taken 20 tons of farm-yard manure as a standard, though in many highly farmed parts of the country no more than 15 tons are usually applied. Twenty bushels of bones are recommended by the Doncaster report, and I have lately found that in the Lothians 1 cwt. of rape-dust is considered to replace 1 ton of farm-yard manure. This proportion of course will vary with the quality of the latter manure; but, whatever quantity of this latter we take as the standard of comparison, it is easy to adjust the proportions of the other substances accordingly. I have not recommended any trial to be made with more than 6 cwt. of guano, because, where farm-yard manure is valued only at 6*s.* or 7*s.* per ton, 5 cwt. of the former would cost as much as 20 tons of the latter.

The above experiments are intended to be made with the green crop and continued during an entire rotation;* any pair of them, however, may be tried on single crops, whether of corn or of turnips and potatoes. In this way it ought also to be tried against nitrate of soda and against bones, upon seeds and upon old grass-lands. The modes in which such experiments may be made will readily suggest themselves to the intelligent farmer. *In all cases the results should be accurately recorded, and if possible published.*

I consider it of importance that an artificial mixture, similar to that above suggested, of which the composition is known, and which can anywhere and by any one easily be made, should be fairly tried against the guano;† because it does not appear, as some have been led to believe, that the supply of this substance on the coast of Peru is by any means inexhaustible.

According to Mr. Winterfeldt the supply of recent guano has diminished materially even in recent times; and in an extract from his letter already given he mentions one extensive deposite of the old guano in the island of Iquique, which was exhausted in 25 years by the local consumption only.

But the diminution is placed in a stronger light by Mariano de Rivero, in a paper published in the Spanish language, but from which an extract is given in Ferussac's Bulletin (sec. I., tom. xi., p. 84.) He says—

"The Spaniards permitted the wise ordinances of the Incas, which ensured the preservation of this valuable manure, to be entirely forgotten. The Peruvians are now aware of this great error, and see with anxiety the period approaching when the guano will no longer be obtained in sufficient quantity to meet the demands of the agriculture of the country. *The discovery of new deposites of the brown guano, which is of very ancient origin, is daily becoming more rare,* while the production of the recent white guano is rapidly diminishing, since, through the freedom of commerce, so many vessels have visited the coast and scared the birds which frequented them."*

If the above account is correct, it is the interest of Peru to prohibit the exportation of the guano; but the introduction of it into this country in the mean time will prove a great national service, if it shall teach us to imitate so valuable a natural production, and, by making available those articles of home manufacture which have hitherto been neglected by the agriculturist, to supply the lack of farm-yard manure, and thereby to raise a greater amount of food than we should otherwise be able to do. Thus at the same time will the chemical arts and the art of culture be bound together by still another tie, and the mutual dependence of all classes of the community, however apparently distinct their industrial occupations, be still more distinctly illustrated.

Durham, 20th October, 1841.

* By this I mean that the effect of these several manures applied *once for all* to the green crop at the commencement of the rotation, should be traced on each successive crop through the entire course of cropping.

† I have not suggested the comparative trial of such substances as those sold under the name of urate, animalized carbon, &c., because, though I have no doubt of their efficacy when prepared after a certain manner, yet the practical farmer has no guaranty that what he purchases this year shall prove equal in virtue to that which he applied to his land in a former season.

THE CULTURE OF SUGAR.

From the Philadelphia Public Ledger.

Until the production of sugar from the maple, and more recently from beets, the production of this *necessary* of human life was supposed to be confined to the tropics. But though maple sugar is the produce of temperate regions, its cultivation is necessarily too limited to supersede extensively the use of tropical or cane sugar, and this cultivation must decline with the settlement of the country. Most of the trees which afford sugar are found in the primitive forests; and as thirty years at least are required to produce a maple tree of sufficient size for sugar, the cultivation of sugar orchards by the present generation, for its own use, is impracticable, and we cannot expect that a people will labor for posterity, in a new country which demands all their labor for themselves in immediate returns. We may add that in our mode of clearing land of forests by *fire* as well as *steel*, the preservation of the spontaneous growth of maples is out of the question. Therefore we can only manufacture maple sugar in new settlements and by an expenditure of labor that might be more profitably employed. The whole quantity of sugar produced in the United States in 1840, was 155 millions of pounds. Of this quantity, Louisiana produced about 120 millions, Georgia about 330,000, and Florida about 275,000 pounds, the whole of which was doubtless cane sugar. This quantity, about 120½ millions, deducted from the whole quantity, leaves 34½ millions for maple and beet sugar. Of this quantity, New York produced 10 millions, Pennsylvania about 2¼ millions, Virginia about 1½ million, Kentucky about 1¼ million, Ohio about 6½ millions, Indiana about 3¾ millions, and Michigan about 1½ million; and of these 34½ millions, the whole was maple sugar, excepting, perhaps, a small quantity produced in Pennsylvania, in the vicinity of this city. The whole of this sugar was consumed at home; for notwithstanding all this production, 120 millions of

* See Poggendorf's Annalen, vol. xxi. p. 606.

pounds was imported for domestic consumption, the whole of which was cane sugar. Thus of 275 millions of pounds of sugar consumed in the United States, about 240 millions are cane sugar. These facts show that the quantity of maple sugar manufactured bears a small proportion to the whole consumption, and that this quantity must annually decline with the removal of the forests.

Of beet sugar, 150 millions of pounds are annually manufactured in Europe; but as cane sugar is cheaper, protecting duties are necessary for the cultivation of the former. But in the United States, the quantity of beet sugar produced is trifling and probably it will not become a substitute, extensively, for sugar cane. Nevertheless, our country does produce a species of sugar which might supersede entirely the consumption of cane sugar, foreign or domestic, and even become an article of exportation. *Indian corn* contains sugar in large quantities, and might be profitably cultivated for it in every part of the Union. According to Beaumé's *saccharometer*, or apparatus for ascertaining the quantity of saccharine matter in plants, the corn stalk reaches to 10 degrees of saccharine matter, which is three times greater than that of the beet, five times greater than that of the maple tree, and fully equal to the cane in the United States. Experiments prove that six quarts of the juice of corn stalks produce one quart of crystallized syrup, or sugar, which is a product of 16 per cent., while thirty-two quarts of maple sap will yield only one quart of syrup. And besides furnishing as great a proportion of saccharine matter as the cane, the corn stalk can be produced, for sugar, within 90 days, while the cane requires at least 18 months of careful and laborious cultivation to bring it to maturity.

To produce the greatest quantity of saccharine matter in corn stalks, the ear must be plucked so soon as it appears; and by this process, all the saccharine matter that would have been used in forming the ear, is retained in the stalk. One thousand pounds of sugar may easily be produced from an acre of corn. Those to whom this seems incredible, will remember that a bushel of ripe corn will weight about sixty pounds, and therefore that fifty bushels, an ordinary crop to the acre, will weight three thousand pounds. Then as nearly all the flour or meal of corn is convertible into starch, and as starch is convertible into more than its weight of sugar, one thousand pounds of sugar to three thousand pounds of corn is not an extravagant product. To this we may add that in some parts of the country, especially South Carolina, Georgia, Alabama, Mississippi, Louisiana and Florida, two crops yearly for sugar might easily be produced. By the removal of the ear so soon as it appears, this whole quantity of saccharine matter is retained in the stalk, in addition to the quantity which it contains when the corn is allowed to ripen.

By proper cultivation, we believe that fifteen hundred pounds of sugar might be produced from an acre, in a single crop, and not less than twenty-five hundred pounds in two crops. We must add that while the machinery for manufacturing cane sugar is cumbrous and expensive, that for corn sugar is light and cheap, the stalk requiring only one fifth of the pressure necessary for cane. Besides, cane being an exotic in the United States, only a small portion of it yields saccharine matter, while the whole of the corn stalk yields it, excepting the *spindle* or top. The stalks, after pressure, with the leaves, are worth enough, it is said, as food for cattle, to defray the expenses of cultivation.

Though no experiments have been made to test the value of corn stalks for sugar, when dried, we doubt not that they are as valuable for this purpose, as when green; for as nothing but the water evaporates in the process of drying, all the saccharine matter must remain; and by the process of straining, the stalk may afterwards be subjected to the press without any loss. This process of drying and subsequent straining is used in the cultivation of beets for sugar; and if it can be applied to corn stalks, as we believe, the cultivation of corn sugar will be greatly facilitated; for in that case, the manufacture can be postponed till the winter or end of the autumn, when most other agricultural labors are ended.

Corn being indigenous in all parts of the union, while the cane is an exotic, and confined to a small southern district, the cultivation of corn sugar may entirely supersede that of the latter. The average crop of sugar in Louisiana is 900 or 1000 pounds to the acre, about one third of the product in Cuba and other tropical regions. And besides, the capital necessary for cane sugar being great, it cannot be cultivated by landholders of moderate means; and of all modes of southern cultivation, cane sugar has been the least profitable. All parts of the United States are subject to frosts, and when they occur in Louisiana, where they are not uncommon, the sugar crop is destroyed or injured; and to escape them, the sugar planters are obliged, when the cane is ripe for cutting, to employ their laborers incessantly during day and night, in cutting and pressing. But on the sugar lands of the south, two crops of corn for sugar might be produced annually, before the appearance of frosts, both yielding 2500 or 3000 pounds of sugar. Hence, besides being a profitable crop in all other states, corn sugar would be a far more profitable crop than cane sugar in Louisiana. We commend this subject to the notice of sugar planters, and advise them to make an experiment in the cultivation of corn. Their preparations for the manufacture are already made in their machinery for cane sugar, and they would be merely required to raise the corn. In Louisiana, corn grows not less than twelve feet in height, and like all other plants produced in southern regions, must contain more saccharine matter than northern corn. Hence, if an acre of northern corn would yield, at the rate of fifty bushels of ripe corn to the acre, over one thousand pounds of sugar, an acre in Louisiana would yield fifteen hundred or two thousand pounds. Then if it be a profitable crop at the north, much more so will it be in Louisiana and other districts of the union where sugar cane is now cultivated.

According to Mr. Ellsworth's report, the quantity of corn produced in the union, in 1840, was 387 millions of bushels; and if the whole of this had been converted into sugar, at the rate of twenty pounds of sugar to the bushel of sixty pounds of corn, which is a very moderate esti-

mate, the product of sugar would have been 7740 millions of pounds. By twenty pounds of sugar to the bushel, we mean that the quantity of corn stalks that would have produced sixty pounds of ripe corn, will produce twenty pounds of sugar. Therefore, if only about a twenty-fourth part of this corn had been converted into sugar, the product would have equalled the whole quantity of sugar, foreign and domestic, consumed in the United States. This quantity, as we have already stated, is 270 millions of pounds; and at the rate of twenty pounds to the bushel, it would require 13½ millions of bushels. This being a small proportion to 387 millions of bushels, and at the rate of fifty bushels to the acre, and one crop annually, could be produced on only 275,000 acres of land. Then if 275,000 acres of land, cultivated for corn sugar will give a substitute for the whole quantity of sugar consumed in the United States, how boundless are their agricultural resources for sugar alone! With such a reserve, the south have no cause to tremble for the loss of their cotton crop for England, through the cultivation of cotton in India.

PROPER TREATMENT FOR CATTLE NEWLY BROUGHT TO THE SOUTH.

From the Ploughboy.

Mr. Editor—By giving publicity to the following letter you will confer a favor on those who feel an interest in improving their stock of cattle. It is superfluous to add that the great skill and acknowledged success of Col. Hampton, in rearing the finest stock in the state, entitle his opinions to be regarded as of the highest authority; and the liberality with which he has communicated the results of his experience entitles him to the thanks of this community. J. T.

Columbia, January 24, 1842.

My dear sir—Without detaining you with an apology, for so long a delay in answering your favor of the 31st ult., I proceed at once to the subject matter of your inquiries. All cattle imported from England, the north and the west, are very liable to be attacked by a fatal disease, which I take to be an inflammation of the brain.

Young cattle, from eight months to one year old, are less subject to it than those more advanced in life. If they survive the summer and autumn, I consider them safe, although great care should be taken of them the second season. They should be brought into the state as early in the fall as possible, kept in good growing condition through the winter, and in the spring be removed to a high healthy position, have easy access to pure water, and their pasture as much shaded as the nature of the ground will admit. In August and September they should be kept in a cool stable during the heat of the day, and at night also, the dew at that season being almost as injurious as the intense heat of the sun.

With these precautions, I think more than half would escape the disease, the first indication of which is usually a languid appearance of the animal, followed by the loss of appetite, short, quick breathing, with more or less fever, and not unfrequently accompanied by a cough.

I have hitherto considered this disease, when once established, incurable. I have recently learned, however, that by sawing off the horns, close to the head, nine out of ten would recover. In two cases only have I known the remedy to be tried, and in both the experiment was successful. I shall be highly gratified if any of these suggestions shall be useful to you or any of your friends; and wishing you entire success in your experiment, I am very respectfully and truly yours,

J. Terry, esq. W. Hampton.

FACTS IN HOG FEEDING.

From Colman's Fourth Report of the Agriculture of Massachusetts.

One of the farmers whom I visited had then in his sties three swine, whose average weight would equal four hundred pounds each. They were fed three times a day, with a mess of 12 quarts of meal to each per day, composed of the meal of oats and Indian corn, mixed in equal parts and stirred in cold water. The price of oats at that time was 42 cents per bushel,—of corn, 84 cents per bushel;—6 qts. of oatmeal would be cts. 8.4; 6 qts. of corn meal would be cts. 16.8, —total, 25 cents 2 mills each per day as the cost of keeping. The price of pork at that time was six to seven dollars per 100 lbs. A gain of two pounds a day, live weight, would much exceed the ordinary gain of a fattening hog, although, in a remarkable case, I have known the daily gain, for eighteen days in succession, to exceed three pounds. At two pounds a day, there must be a considerable loss in this feeding. The prices of grain, however, were above the usual prices; and the price of pork was depressed.

Another farmer, in fattening three swine, allowed them one peck of meal each per day. The mess was composed of Indian corn, buckwheat and oat meal, mixed in equal quantities. The price of corn was 84 cents; buckwheat, 56 cents; oats, 42 cents per bushel. One peck of this mixture cost fifteen cents.

One of the most exact and careful farmers in the county fattens his swine chiefly in the winter, so as to have them in the market in March, when pork generally bears a good price. He has close sties, which are kept with great neatness; his swine are fed with exactness and punctuality; and in severe weather, he endeavors, by closing the windows and doors, to keep up a moderate temperature in his sties by a fire in the furnace, where he cooks his food for his swine. Another farmer in Leverett, who makes excellent pork, prefers the winter fattening of swine, but is extremely careful that they shall not suffer from cold, his sties opening to the south, and being always abundantly littered. The farmer first alluded to has made trial of molasses for his swine, having purchased a condemned lot at a low price. He gave at the rate of half a pint per day to each hog, with great advantage as he supposed, though no accurate observation or test was made to determine the gain, and the proportion of that gain, if any, to be attributed to this article of food.

A farmer in Buckland considers ruta-baga, fed raw to swine, of equal value as raw potatoes. This judgment, he says, is the result of his own experience. A farmer in Hawley thinks swine

may be fatted to great advantage, when the price of pork is 10 cents in the market and corn is one dollar per bushel. This is rather a loose estimate, and I should not quote it, but for my great confidence in this farmer's long experience and careful judgment. An excellent farmer in Conway puts up his hogs to be fatted in August, and he greatly prefers pumpkins to potatoes. There is no doubt that the pumpkin is a very nutritious vegetable. A very large amount may be raised upon an acre. The difficulty lies in their preservation; but when they can be used to advantage early in the season, they are a very profitable crop.

A farmer in Charlemont says, that, after twelve years' experience, he deems apples, bushel for bushel or pound for pound, of equal value with potatoes for feeding swine. He prefers sweet apples, but is not confident that they have any advantage over sour apples.

The raising of pigs is spoken of by several farmers as an excellent business. This can seldom be done to advantage unless in connexion with a dairy. A farmer of Deerfield sold the pigs from two sows in one season for fifty-four dollars. Another in Gill sold the litters of two sows, in the spring, for fifty-nine dollars seventy-five cents. These results are, to a great extent, accidental; and depend on so many contingencies that no general rule can be drawn from them. A farmer in Northfield, on the 27th September, showed me three fine, thrifty swine, about one year old, nine tenths of whose feed, since the 13th May, had been obtained from one eighth of an acre of clover, cut and given to them in a green state.

SHEEP-KILLING DOGS.

From the Kentucky Farmer.

We noted, lately, that a petition had been laid before the House of Representatives, praying a tax on dogs, with the view of diminishing the destruction of sheep. The Commitee on Propositions and Grievances, to whom the petition was referred, have asked and obtained a discharge from the consideration of the subject; and as the petition was drawn by the Editor of this paper, leave has been obtained to withdraw it, for the purpose of printing it, as will be seen below. We drew up and offered the petition under a sense of duty; for our editorial position has furnished us facilities for learning that the farmers of the country suffer an enormous evil in the sheep-destroying propensities of dogs. We have received numerous letters and had countless verbal statements, from every quarter, of the loss annually sustained in this way; and we believed a due regard to an important interest of the state would have prompted the legislature to interpose some effectual remedy. The facts stated in the petition, we believe, are substantially true; the principles of the proposed law, in our judgment, are plainly defensible; and we deem the neglect of the legislature to protect the country from the evils incident to the enormous grievance complained of, a gross dereliction of duty. If a thousand tigers were transported from the jungles of Bengal and turned loose in the land to ravage and destroy the domestic animals, the propriety of making an organized effort, under legal sanction, for their destruction, could be defended by no arguments not applicable to that of destroying the superfluous roving dogs which swarm thoughout the land.

We are well aware that there is always attempted to be got up an odium against any one seriously moving a remedy against this evil; and we knew an instance of a most worthy man in a neighboring county, almost losing his election to the legislature for signing a petition on this very subject. Every species of opposition is offered to any movement of the sort. The good-natured crack jokes and provoke laughter and fun; the ill-natured swear most lugubriously; and there is another class, a sub-genus of political demagogues, who rave about "*rights*" and "*liberty*," but have no respect for the rights of others. But never a one condescends to favor with an argument against the justice, the policy, the expediency or necessity of an appropriate remedy for the intolerable evil.—*Ed. Ky. Far.*] * * * *

Petition of Tho. B. Stevenson, praying a tax on dogs.

The undersigned, holding a position which affords him many facilities for collecting information on the subject of this petition, is enabled to speak knowingly of an intolerable grievance suffered by a large number of the farmers of this Commonwealth and to which all are in danger of being subjected; and he conceives it his duty respectfully to present the subject to the General Assembly, praying such relief as it is in the power of legislation to grant.

The grievance complained of is the destruction of sheep by dogs. The undersigned has had much conversation with gentlemen from every quarter of the state, and he finds this grievance generally complained of. He believes that an annual loss of not less than one hundred thousand dollars is sustained by the country under this grievance. There is scarce a neighborhood in which farmers are not sufferers. Nor is the actual loss occasioned by the killing, wounding and scattering of flocks of sheep by dogs all that the country sustains in this matter. The business of wool-growing cannot be extended, without great if not entire risk, while the present evil remains. The undersigned perfectly well knows that, but for this oppressive grievance, flocks of sheep would be found grazing on the hill lands of the state, so well adapted for the raising of sheep, which are now lying idle and unproductive, because the owners fear to risk their flocks to the ravenous propensities of roving dogs. To say nothing of the intrinsic justice of removing this grievance, there is, in the present condition of our industrial interests, nothing more desirable and important than the extension of our means of production, and a change, to some extent, of our agricultural staples. These are few branches of industry of equal importance with the wool business; and its extension in Kentucky is demanded by every consideration of economy and regard for our domestic interests. And if we could extend our means of producing wool, the extension of our manufacturing interests would be as great as that of the agricultural. Our hill lands, now lying desolate and waste, can be made to sus-

tain flocks of sheep that would annually add untold thousands to our production; and their wilderness solitudes can become the abodes of a hardy, industrious and virtuous population. Yet the undersigned has known many sensible farmers, entertaining strong convictions of the practicability and productiveness of sheep-husbandry on our hill lands, utterly decline the business for no other reason than the fear of the destruction of their flocks by roving dogs. Scarce a day passes but we hear of their ravages. It is not a sufficient remedy that it is the common understanding that sheep-killing dogs may be killed wherever found. They are not always found; and if they were and all were destroyed, their destruction neither atones for the loss sustained, nor prevents other ill consequences. The evil that dogs do lives after them. A flock of sheep, once disturbed by night-prowling dogs, suffers probably greater loss than the death of a portion. The living are ever after more timid and fearful, and either run wild or grow diseased; so that, in either case, their value is seriously injured.

Every one of the least observation knows that there are at least four times as many dogs in the state as are necessary for any purpose of utility; and consequently at least three-fourths of them are not only actual consumers of food, depredators in a thousand ways, but a nuisance in all respects, to say nothing of their sheep-killing enormities. The undersigned does sincerely believe that it is the duty of the legislature to suppress these evils by severe taxation or otherwise; and any effective measure will be sanctioned alike by the wishes and interests of the people.

Not the least degree of hostility is felt by the undersigned towards dogs or their owners, when kept in proper numbers and duly trained for useful purposes. But it is utterly intolerable that the honest interests of productive industry are to be seriously injured by packs of supernumerary dogs. If severe taxation were adopted, the number of dogs would be reduced to that which would usefully serve the wants of the country; and they would then be trained for useful objects, kept at home and restrained from mischief; for it is seldom a dog attacks sheep on his owner's farm.

The danger from that horrible disease, hydrophobia, more terrible than death itself in its direst form, would be diminished by reducing the number of dogs. The life of one good citizen is worth infinitely more to the commonwealth than all the vagrant dogs that swarm in the land, making night hideous with their infernal howling, consuming the food of the land, committing innumerable depredations, and destroying flocks of innocent and useful sheep.

The undersigned prays the legislative interposition to remedy these evils in a manner at once effective and consistent with the rights and interests of all concerned. They who desire to keep dogs for purposes of utility, should be allowed to have them on the payment of a very moderate tax, such as a good citizen would cheerfully pay for a benefit secured and enjoyed under a law designed to remedy a great evil and protect the rights and interests of all. The undersigned is not entirely confident that the following scale of taxation would be precisely adequate to the desired object or strictly just to all interests; but he submits it as embodying the principles of a law which the wisdom of the General Assembly could render efficient and just.

The owner of one dog to be taxed one dollar; of two dogs, two dollars; of three dogs, four dollars; of four dogs, eight dollars: of five dogs, sixteen dollars: and so on. And all dogs unclaimed, or on which the tax is not paid, and others running at large, to be killed forthwith by any one. Respectfully submitted,

THO. B. STEVENSON.

BLACK THE WORST COLOR FOR PAINTING WOOD WORK IN THE OPEN AIR.

There is nothing that will prove this evil more than by observing the black streaks of a ship after being in a tropical climate for any length of time. It will be found that the wood round the fastenings is in a state of decay, while the white work is as sound as ever; the planks that are painted black will be found split in all directions, while the frequent necessity of caulking a ship in that situation likewise adds to the common destruction; and I am fully persuaded that a piece of wood painted white will be preserved from perishing as long again, if exposed to the weather, as a similar piece painted black, especially in a tropical climate. I have heard many men of considerable experience say, that black is good for nothing on wood, as it possesses no *body* to exclude the weather. This is indeed partly the case; but a far greater evil than this attends the use of black paint, which ought entirely to exclude its use on any work out of doors, viz. its property of absorbing heat. A black unpolished surface is the greatest absorber and radiator of heat known: while a white surface, on the other hand, is a bad absorber and radiator of the same; consequently, black paint is less preservative of wood than white. Wood having a black surface will imbibe considerably more heat in the same temperature of climate than if that surface were white; from which circumstance we may easily conclude that the pores of wood of any nature will have a tendency to expand and rend in all directions, when exposed under such circumstances; the water of course being admitted, causes a gradual and progressive decay, which must be imperceptibly increasing from every change of weather. The remedy to so great an evil is particularly simple, viz. by using white instead of black paint, which not only forms a better surface, but is a preventive to the action of heat, and is more impervious to the moisture. The saving of expense would also be immense; and I am convinced that men of practical experience will bear me out in my assertion. —*Trans. Society of Arts.*

EIGHTH AGRICULTURAL MEETING AT THE STATE HOUSE.

From the New England Farmer.

Subject—Manures.—Mr. Buckminster (Editor of Ploughman,) said he may be rather heterodox in some of his notions in regard to manures. But

he has spent much time *in the fields*, and would tell what he has found there. It is a common notion that there is nothing like *hog manure*; he does not believe it. Used once to think that horse manure was poor stuff—but if it be properly composted with litter and urine it will *last longer* than any other manure. We are deceived in regard to hog manure—it works *quick*—but does not last. One cow properly tended and littered will make twice as much manure as one hog. Neither will make much unless they are well fed.

Many old maxims are not sound, and such as are unsound should be discarded. Most people in letting farms, make it a rule that the *hay* shall not be sold. But he would let a tenant sell *half* the hay, if he would not raise grain. The grains are the great exhausters. You may make any farm manure itself, provided you sell half the hay, if you do not raise grain, and if you save all the liquid manure. Sheep manure he has always found to be light stuff—and where his sheep run upon the mowing lands in autumn, and feed close, he gets not more than half as much hay the next year as on other lands. Some say that a cow will eat as much as ten sheep: he would say she will eat but little more than five sheep.

Mr. Stanley, of Attleboro', said that people are often deceived in regard to their own practices. We put much more materials for manure into the hog pen than we put into the heap of cow manure. Did we mix as much muck, earth, &c. with the cow dung as we do with the hog dung, we should find that the barn manure would not last longer than that from the hog yard. If we put ten loads of materials into the yard for one hog, the manure will be weak; if we put but three or four, it will be good. It is best always to put in enough to absorb all the liquids. For each hog he would put in two or three loads as soon as the yard was cleaned out in the spring, and would add as much more at different times during the summer. If he wanted to put his hog manure on cold clay lands, he would put gravel into his hog yard.

Vegetable manures.—Many farmers miss it in not turning the sward often enough: much manure *grows* upon the land. But it will not grow upon the field for more than three or four years. This manure consists of the stubs, roots and leaves of the grass. There will be no more of it at the end of seven years, than at the end of four. Therefore if you do not plough up after mowing three or four years, you lose the opportunity of *making* in this way. The quantity of vegetable matter upon the acre is said to be about twelve tons.

A gentleman in his neighborhood, who is a good and successful farmer, puts half of his manure—the long manure—upon the sward, and turns it under. Manures also in the hill. Takes off the corn in autumn, harrows the ground, and puts in rye and hay seed. His crops of rye have been good, and his grass has done well.

Mr. Putnam (Editor) said the practice just described was such as he had followed for years. He turned down one half of his manure—the long manure—and let it remain there under sod for five or six years. The corn had done well—very well—and the grass (which he sowed among the corn in July,) had done well the first two years, and in the third and fourth held out better than it had ever done before on the same fields. This plan of turning half the manure under the sod, he liked on warm lands, but on cold ones he would keep it nearer the surface.

Mr. Buckminster would like to know what was the experience of farmers as to the comparative benefits of *spreading all* the manure for corn, and of putting a part in the hill. He used once to think that he could not bury his manure too deep, but he was mistaken. Has waited seven years to hear from some that he buried, but no accounts from it have yet been received. He thinks it better to form our manures into composts and keep it pretty near the surface.

Mr. Gardner, of Sekonk, said it is customary in his vicinity to spread part of the manure on the surface and plough it in—and to put part in the hill. The best farmers have been accustomed to do this, and by this process they obtain their best crops. The spreading of all the manure is now more common than formerly.

Mr. Putnam said he had made an experiment in 1839. Half the manure (4 cords per acre,) was turned under the sod. Then, on a part of the field, the remaining half of the manure was put in the hill; on another part the manure was spread on the surface of the furrows and harrowed in. The corn manured in the hill did best in June, was much the largest in the early part of July, but in October, the part where the manure was all spread gave 31 bushels, where that manured in the hill gave 30. Had he have judged by the eye, and with the impressions upon his mind made by the early part of the growth, he probably should have said that the part manured in the hill did best; but the half bushel told a different story.

Mr. Lathrop, of South Hadley, thinks the question, as to the proper *place* for the manure, turns upon the wetness or dryness of the soil. He would not manure in the hill on light lands, but he would on heavy. There can be no general rule.

He would advise every farmer to have his horse manure thrown into the hog yard; the hogs keep it from burning, and make it worth double what it would be if burned.

In his vicinity, much of the long manure is spread upon the mowing lands. These lands are also plastered, and then two good crops are taken from them each year. He alluded particularly to several lots of land which, thus treated, give four tons and more per acre, annually, for many successive years.

PARTICULAR RESULTS OF FARMING IN MASSACHUSETTS.

From Colman's Fourth Report of the Agriculture of Massachusetts.

Facts are in general so interesting and so important, that I am always desirous of recording them, leaving it to others to make such inferences from them as they may deem proper. My principal solicitude is, that they should be well attested, and of such a character as to suggest useful instruction to others. They are the only infallible teachers and their lessons cannot be controverted. It may be safely asserted that there is nothing which has been done which cannot be done again; and under the same circumstances and influences, the same results will follow. These

established truths render facts of so much importance, and make them the safest of all teachers.

Example 1.—Management of seven and a half acres of land in Northfield. The land is alluvial; of good quality; on the banks of the Connecticut.

In 1828, the land was leased; the proprietor to furnish fifty buck-loads of manure from his barn-yard; and to receive, as rent of the land, half of the whole product. He received half the top stalks, all the bottom stalks, and twenty-five bushels of corn per acre.

In 1829, the land was leased on the same terms, and he received as above the coarse fodder, and twenty-two and a half bushels of corn.

In 1830, the proprietor leased it for broom corn, and stipulated to deliver on the ground six loads of manure to the acre. The brush, prepared for market, one half the crop, which he received as rent, amounted to twenty-seven dollars per acre; price at which the brush sold in this case not ascertained.

In 1831, he leased it again for broom corn, delivering upon the land six loads of manure to the acre, at a cash rent of sixteen dollars per acre.

In 1832, without manure, he sowed it with oats, and obtained from thirty-three to thirty-five bushels to the acre, which he sold at forty-two cents per bushel.

In 1833, without manure, he obtained an average yield of twenty bushels of sound wheat to the acre, valued at one dollar fifty to one dollar seventy-five cents per bushel.

The land was valued at sixty dollars per acre; at which price, at that time, land of the same quality in the immediate vicinity was sold.

Summary per acre.

In 1828, 25 bushels of Indian corn, at 75 cts. per bushel,	$18 75
" 1829, 22½ do. do. do.	16 87½
" 1830, returns from broom corn sold,	27 00
" 1831, rent of land in cash,	16 00
" 1832, 24 bushels of oats, at 42 cents per bushel,	10 08
" 1833, 20 do. of wheat, at $1 50 cents,	30 00
	118 70½
Six years' interest upon 60 dollars, price per acre,	21 60
Net profit of six years upon each acre,	$97 10½

The manure was furnished on the farm, and the stalks and straw may be considered as a full equivalent for the manure, seed and thrashing.

2. Produce of three and a half acres of land in Deerfield street, in 1833.

Hay, 3½ tons, at 12 dollars per ton,	42 00
Winter wheat, 11 bushels, at $1 50 per bushel,	16 50
Stubble and clover, one ton, at 4 dollars per ton,	4 00
Corn fodder, three tons, valued at	10 00
Indian corn, one hundred and twenty bush. at 80 cts.	96 00
Potatoes, one hundred and seventeen bush. at 20 cts.	23 40
Apples, sixty bushels, at twelve and a half cents per bushel,	7 50
Pumpkins, one cart-load,	0 00
	$199 40

3. I give, in the subjoined case, the actual expenses of cultivating several lots of land on the same farm the same year, with the returns. The expenses include every thing until the delivery of crops in the barn, with the exception of thrashing the grain, and the interest upon the value of the land. I have myself affixed the value of the crops, as nearly as I could ascertain it at the prices then current in the county.

1. Four acres and 106 rods in Indian corn.

Whole expenses of cultivation,		$90 83
Returns—		
352 bush. of corn, at 75 cents,	264 00	
Corn fodder, ten tons, at $4	40 00	
		304 00

2. Three and a half acres in corn.

Whole expenses of cultivation,		109 75
Returns—		
Corn, 236½ bushels, at 75 cents per bushel,	177 37½	
Fodder, 9 tons, at 4 dollars,	36 00	
		213 37½

In the former case, gypsum and ashes only were used, charged at $5 50 cents; in the latter case, 35 loads of barn-manure were used, charged at one dollar per load.

3. Five acres in oats.

Expenses of cultivation and seed,		35 50
Returns—		
280 bushels oats, at 42 cents,	117 60	
Straw, say four tons, at $3	12 00	
		129 60

4. Five acres in rye.

Expenses and seed,		21 50
Returns—		
60 bushels, at one dollar per bushel,	60 00	
Straw, say four tons, at $3	12 00	
		72 00

5. Two and a half acres in winter wheat.

Expenses and seed,		13 75
Returns—		
20 bushels wheat, at $1 50,	30 00	
Straw, two tons, at 3 dollars,	6 00	
		36 00

6. Two and three-fourths acres in spring wheat.

Expenses of cultivation and seed,		15 58
Returns—		
38 bushels of wheat, at $1 50 cents per bushel,	57 00	
2 tons of straw, at 3 dollars,	6 00	
		63 00

7. Fourteen acres in grass, home lot.

Expenses of getting two crops, in both 45 tons,	65 00
Forty-five tons of hay, at 8 dollars per ton,	360 00

8. Seven and a half acres in grass, in meadow.

Expenses of getting the hay, 15 tons,	20 75
Value of the hay, 15 tons, at 8 dollars,	120 00

The foregoing may be considered as examples of extraordinary success. I give them as such. They are examples of extraordinary success and extraordinary skill and good management. The success is the result of the good management. The good management others can command; and consequently the same results are within their power. Men pretend that there is a great deal of "good luck" in these cases. There is very little of what may be termed good or bad luck in

this world's affairs, and these terms are mainly used to soothe a conscience troubled with a sense of its own recklessness, negligence or indolence.

INDIAN CORN FOR FODDER.

From the New Genesee Farmer.

The cultivation of Indian corn for fodder may be well recommended to the farmers, especially where pasturage is deficient, or in a season when the crop of hay is likely to be small. Among the farmers who supply the cities with milk, it is a favorite crop, and is given to their cows at night and morning to assist a short pasture. In such cases it is sowed at successive seasons, every week or fortnight, so that the crop may be coming on as needed. It is sometimes cut when it is knee-high, and then in general it will start a second time, so that another cutting may be obtained. This should not, however, be confidently relied upon. Where it is wanted for green feed, it is of course advisable not to cut it until the plant is in perfection; we do not mean until the seed is ripened, but until the leaves and stems are as abundant and large as they are likely to be; that is when the flower is protruded, and the ear formed, and yet no part of the plant has become too hard to be completely eaten up by the cattle. Every farmer, therefore, may make his calculation as to the time of planting. The earlier he plants, the sooner he will have the fodder and the more of it to give to his stock; and by planting at successive times according to his convenience, he may keep up a supply of succulent food to the very end of the season. None need be lost; and every leaf and stem of it should be saved, even after the frost has killed it.

We have seen the plant cultivated to great advantage for soiling cows; in many instances; in one where twenty cows were kept; in another where a hundred cows were soiled. In the latter case several acres were sown with corn for this purpose; and it was cut and brought into the barn as wanted. There was no feed of which the stock were more fond; none which produced more milk; and none obtained at a less expense. It was all cut short by a machine, and while gathered green every particle of it was consumed. When in the autumn it became dry it was steamed for the stock. Among the milk farmers, near the cities, its cultivation is constantly increasing.

We have known it likewise much used for store hogs. Where pasturage is deficient, or where they are kept in sties, no green food is more relished by them or more conducive to their thrift. In this case, however, it is of course given to them in a green and succulent state.

We have not known it cultivated extensively for winter fodder, but there is no reason why it should not be. In this case it would be desirable to sow it early, if we would have the largest crop, and let it come to what maturity it will. The value of well cured corn fodder for stock is settled. The cattle have determined the question long ago by the relish with which they eat it; and the good condition in which it keeps them. The amount of well dried corn fodder, including butts as well as tops, where the crop is fifty bushels, is generally estimated at two tons; this of the small yellow flint variety of corn; the southern gourd seed variety and the western corn produce a much larger amount. Farmers in general are disposed to estimate the fodder upon such an acre of corn, well saved, as equal, for any neat stock, to one ton of English hay. Some place it at one and a half ton; none lower than three fourths of a ton.

The only instance which has come within our knowledge, of ascertaining with any exactness the actual amount of fodder or stover upon an acre, was in Pennsylvania, where we infer the gourd seed variety was cultivated, and where the crop amounted to 66 bushels. In this case.

	Tons.	*cwt.*	*lbs.*
The blades, husks and tops, when cured, amounted to - -	1	6	13
Stalks and butts - - -	1	7	00
	2	13	13

How much could be obtained by sowing it exclusively for fodder, we have no means of determining with any accuracy.

Nor have we any certain prescription to give as to the amount of seed to be used for an acre; certainly not less than half a bushel, nor more than two bushels. Corn is a plant which, in rich soils, tillers abundantly or throws out many suckers, unless where it is very thickly sown, in which case it conforms to every other plant in its habits of growth, and runs up in a slender form like bushes in a thick swamp. Many persons advise to sow it broadcast, in which case it admits of no after cultivation; and the weeds, if the land is rich, will check its growth and fill the ground with their seeds. It is best to sow it in drills two feet apart, and quite thickly in the drills, scattering the seed over a space in the row, six inches or a foot in width. It may then be ploughed or passed through with a cultivator once at least; and in a measure kept clean from weeds. It is believed that as much fodder may in this way be obtained from an acre as if sown broadcast.

The land cannot be made too rich for it; and it need not be gathered until it is ripe. There may be a good many imperfect and some ripened ears among it; but the cattle will not like it the less on that account. The Irishman was asked how he kept his horse so sleek and fat; and "faith!" says honest Pat, "he has nothing but wheat straw, your honor, and that is not *half thrashed*." It is a prevalent opinion that the top stalks of Indian corn when cut in a succulent state, and cured quite green, are better than when left to ripen. It is believed that this is an error; as the experience of observing farmers, we think, will show that their cattle do better, prefer them, give more milk and show better thrift, when fed upon the butt stalks, that is the leaves and husks upon the butts after the corn has been gathered, than upon the top stalks gathered and cured in a green state, as above described. The fodder need not then be harvested until it is, as it is termed, nearly dead ripe. Corn fodder when cut green, especially late in the season, is cured with great difficulty; but if left to stand until it is either killed by the frost or reaches maturity, it is as easily saved as hay. In putting away corn fodder, we have found it advantageous to insert, occasionally, layers of wheat straw. The sweet flavor of the corn fodder is communicated in some measure to the straw; and the straw serves to keep the

corn fodder from being injured by heating. No fodder suffers more or sooner from wet or rain than corn fodder. Every possible pains should, therefore, be taken to avoid this; and it is a good way to hang as much of our corn fodder, as we have room for, on the beams and on poles extending over the barn floors, and in sheds where it will be out of the reach of the cattle.

As to the kind of corn to be sown, the southern gourd-seed or the western corn, will undoubtedly give the largest weight; but much of it will be in the butt, no part of which will the cattle eat. Our common northern small flint corn will yield a large amount to the acre, as it will bear thick sowing; and the main stalk is not so large but that a good deal of it will be eaten, especially if cut up.

HABITS OF THE CURCULIO, AND MEANS FOR ITS DESTRUCTION.

From the Magazine of Horticulture.

The *curculio* is one of the greatest enemies of the plum; indeed, in many sections of the country, the whole crop is frequently swept off by its attacks. When its habits are well known, however, a little care will enable us to rid our gardens of this insect, so destructive to stone fruit.

The curculio is a winged insect, which emerges from the ground about the time when the trees are in blossom, and punctures the fruit almost as soon as it is formed, depositing its eggs in the tender skin of the swollen germ. When the fruit has reached one third of its size, if we observe it closely, we shall discover the scar of this puncture made by the insect, in the shape of a semi-circle or small crescent, about a tenth of an inch in breadth. The egg has now taken the larva form, and the latter is working its way gradually to the stone or kernel of the fruit; as soon as it reaches this point, the fruit falls from the tree, and the worm now leaves it in a few days, and finds its way into the loose soil beneath the tree. Here it remains until the ensuing season, when it emerges in a winged form, and having deposited its eggs to provide for the perpetuity of its species, perishes.

As it is found that the curculio, though a winged insect, is not a very migratory one, the means taken to destroy it in one garden are not without efficacy, though the neighboring orchards may not receive the same care. As the fruit, when it falls from the tree, contains the larva, it is evident that if we destroy it before the insect has time to find its way into the soil, we shall destroy, with it, the curculio. In small gardens, it is sufficient to gather all the fallen fruit every morning, during the period of its fall from the tree, and throw it in the hog-pens, when the whole will be speedily consumed. In larger orchards, where it is practicable, the hogs may (the trees being protected) be turned in for the short time in the season while the fruit is dropping, and they will most effectually destroy the whole race of insects of the current season. Indeed, in large plum orchards, this practice is found a very effectual remedy for the attacks of the curculio.

In small gardens that have come under our notice, formerly much troubled with the attacks of this insect, where the practice of gathering the fruit and destroying it daily for a short period has been pursued, the insect has failed to make its appearance after a couple of years, and the trees have borne abundant crops of fine fruit. In addition to this, we would recommend the application of clay about the roots of plum trees, in very light sandy soil.

It is sometimes the case that the plum will be many years in coming into bearing, where the richness of the soil induces too great a luxuriance of growth. When this is the case, the ground should be partially removed from the roots, which should be pruned or reduced in number one fifth or one fourth, and the soil replaced. This should be done in the autumn, and will rarely fail in bringing about a profusion of blossom buds and a good crop of fruit. A. J. DOWNING.

Newburgh, N. Y., Feb. 1842.

ROTATION OF CROPS.

To the Editor of the Farmers' Register.

Shirley, March 8th, 1842.

The interesting and well-written communication on the "rotation of crops," under the signature of N., in the February number of the Farmers' Register for 1842, reminds me (as I see he quotes my five-field rotation) that I ought in candor to acknowledge the change I have made in it, and the reasons for it; and while I do so, I must pay the tribute so justly due to the author of "Rivanna," in the February number of the Farmers' Register, 1840, for his better judgment in recommending his five-shift rotation in preference to the one I at first adopted.

In 1840 I changed my four-field system to a five-field one, viz.: wheat, corn, wheat, clover, clover pastured off; but I found, the very first year, after grazing the second year's clover field heavily, to remedy insects, in consequence of the dry fall, it was almost impracticable to fallow it up for wheat. And as we generally have dry seasons at that time, it makes an insuperable objection to the system, for the labor of fallowing up a hard trampled field, in a dry season (the land breaking up in large clods, which clods have to be reduced by the rollers, harrows, hoes, &c.) is immense, on our stiff James river lands, and makes it insuperably objectionable. The crop of wheat succeeding, though, was very fine, the straw immense, and, where it did not lodge, very fine grain. I therefore last year changed the rotation to the one recommended so highly by Rivanna as the "beau ideal" of a system, viz.: corn, wheat, clover, wheat, clover, and have no doubt I shall find it a good one from the recommendation of such able authority. But I think if my lands had been as light and rolling as the author of N. describes his to be, I should have preferred the other five-field rotation, viz.: two years in clover before fallowing for wheat; as I consider it very important, from my late experience, that land should lie out longer in grass than one year. It is the great defect, I think, in our systems on James river, that the land does not lie out long enough in grass to resuscitate. With light land, such as N. describes his to be, the fallowing for wheat would never be very laborious; for light land never becomes very hard, however dry the season may be, and may be fallowed with ease, and I think with success, after two years in clover, the first,

allowed to fall and rot on the ground, as a manuring, and the second year pastured off, to leave a clean rich turf for wheat. The pasturing would certainly benefit light land very much, for trampling is very necessary to it to make wheat or clover. In fact white clover will not succeed on any land without trampling, and red clover is very much of the same nature, though not to the same degree. His land being rolling, would only have one hoe or washing crop in five years, and that would not wash it much when he leaves out a part through the winter for oats, provided he lays by his corn early, and lets it get grassy, to cover the land during winter, with the dry crop grass, and none the less corn would he make for it, as I believe there is more corn lost than made by late working.

I think there are some objections to Rivanna's system, as I propose to practise it. First, when you do not graze the clover at all, which is to be fallowed for wheat, as is my intention, and turn in all the clover, it is very difficult and tedious to plough, chokes the ploughs, and makes bad and slow work; and again, after a heavy crop of wheat on clover fallow, your clover is apt to fall from the wheat lodging, and killing the young clover, and then you have a bad pasture for the next year for your stock. The first objection Rivanna remedies by partial grazing; but that I do not wish to do, as I think it very important in the four or five-shift system either, to return all of the clover to the land in one of the years at least, and should prefer to encounter the trouble of turning in the clover to robbing the land of it; for however much the two systems have been lauded, I think there is very little doubt they are sufficiently exhausting on most of our Virginia lands to require all the clover once in the course of the rotation to resuscitate them; though with that, and the manure of the farm, I think good land will improve sufficiently fast for any reasonable man; and with the addition of marl, or lime, will improve very fast.

Another objection with me to Rivanna's partial grazing both clover fields, instead of rigidly grazing the pasture one only—it would defeat the chief object I had in view in changing my system from four to five fields, viz., remedying the insects in my land by grazing, in which I have great confidence.

Thus far I am very well pleased with Rivanna's rotation. Last year, (1841,) I had a very good clover pasture after the fallow wheat of the year before, and it stood the grazing admirably well, (having 80 head of cattle, 100 sheep, 100 hogs, including pigs, and occasionally 20 horses and mules, on 160 acres, very nearly two head to an acre,) and the grazing made this winter's ploughing for corn very good, as trampling makes winter ploughing easier, instead of rendering it more difficult, as it does summer fallowing for wheat. I have a very fine promise for pasture this coming summer, from last year's fallow wheat, and if I can only continue to have good pasture every year from the clover of the succeeding year after the fallow wheat, I shall be very well satisfied with the system.

I ought to mention that I only sow the cornfield wheat in clover, relying on the volunteer clover on the fallow wheat for the next year's pasture, which I suppose is the practice of Rivanna and all others who pursue his system, as there is generally plenty of volunteer clover on the fallow wheat, though I have always remarked that it was much less apt to turn out a good clover field than the corn-land wheat, sown in clover, owing to the lodging of the fallow more than the cornfield wheat, and also to the corn-land being much cleaner, as foul land is a great enemy to clover.

My system will vary somewhat from Rivanna's. Mine will be corn, wheat, clover, wheat, clover pasture heavily grazed, to go in corn again at the beginning of the next rotation. His is, corn, wheat, clover partially grazed, wheat, clover partially grazed, to go in corn again at the beginning of the next rotation. My object is, by heavily grazing to try to remedy the innumerable insects the clover has introduced in my land, such as clover worm, cut worm, wire worm, and all the variety of grubs we have in this country, which render it so difficult to pitch a crop of corn, and sometimes a crop of wheat too. For sometimes in the fall I have had my wheat very much injured by a little worm, resembling the wire worm, (which does so much injury to corn,) only a little shorter, which I called clover worm, from finding it in the clover fallow wheat, and not in the cornfield wheat at all.

HILL CARTER.

THE ADVANTAGES OF THE CLIMATE OF THE UNITED STATES OVER THAT OF ENGLAND.

From the New Genesee Farmer.

Your correspondent, W. Garbutt, of Wheatland, gives to the English farmer the advantage in length of season over the farmer of the United States, without even adverting to the very great advantage we have, in the superior stimulating power of our much warmer and more kindly season of vegetation. If by some change in the solar system, the power of terrestrial magnetism, or some involution in nature's course, the soil of England could be so far stimulated by the sun's rays as to produce Indian corn to perfection, should we any longer hear of her "starving population," reduced to live on the miserable bread made of damp mouldy grain? It is true that England has less severe cold weather and a shorter winter than we have; but look at the slow process of vegetation there as compared with that of the United States; her late harvest crowded into the short, cloudy, and even wet days of autumn, and it is not surprising that her corn is damp and mouldy. What would become of our ease-loving farmers if they had to encounter the cold, sour, wet climate, and slow vegetation of that country called merry, not sunny, England? Would they not be reduced from bacon and corn bread, to turnips and pea soup, from the delicious wheaten loaf and hot rolls, to oat cakes and potato broth?

Mr. Garbutt says that roots cannot be cultivated in this country to the same extent, *advantageously*, as in England. Very true, but then does not our Indian corn, that thrifty precocious king of edibles, (it being both food and fodder, oil and sugar,) render the like extensive cultivation of roots unnecessary? But we deny that roots may not be as easily cultivated in the United States as in England. If our more sunny champaign country is not as well suited to the turnip and potato, as cool and

misty England,—our early planted sugar beets never grew in greater perfection with us, than during the last summer, the hottest and driest season we have had in many years; and there is little doubt but that one acre of sugar beets is worth two acres of turnips.

We fully agree with Mr. Garbutt that it would be folly for our farmers to follow the rural economy of England in all its variety, but for very different reasons than a part of those set out in his otherwise interesting and well written article.

Waterloo, N. Y. S. W.

ADDRESS TO THE KANAWHA, MASON, AND CABELL AGRICULTURAL SOCIETY. GUYANDOTTE, Nov. 11, 1841.

By Gen. Peter H. Steenbergen, of Mason county.

Gentlemen of the Agricultural Society:—Another year has rolled on, and we are once more assembled under the rules of our organization. The spirit and feeling of its members present, together with the exhibitions on this occasion, will show whether it has been productive of all the advantages so earnestly desired by its formation.

Whatever of success and prosperity such institutions are calculated to insure will depend much upon the zeal, energy and indomitable perseverance of all who belong to the society. We should permit no trivial circumstance to delay us from promptly fulfilling the duties incident to our situation; suffer no rivalry for the prizes to estrange, or engender unpleasant feelings in their distribution. We should move on in peace and harmony, combined as brother farmers embarked in one common cause, and sailing under the flag of improvement.

It is difficult for me to determine what topic would be most acceptable to the majority of my friends present. This being the first meeting held in your county, and its good effects, if any, intended for your improvement, I have thought it best to take a review of some peculiarities existing in your soil, some causes operating to your benefit or injury, and thus correctness and truth will be equally applicable to all sections placed under similar circumstances. With your lands I am well acquainted. I will now notice the various shades and character of soil that your large county furnishes; and in doing so I beg of you to believe, that whatever remarks I may make are predicated upon a judgment matured and formed by a comparison of this section with that of others in our country.

Commencing then at this place, the town of Guyandotte, and descending the river, you are first struck with the infinite variety of soil your bottoms afford; first alluvial, then an elevated table of sandy land, and sunken ponds resting on a substratum of clay impervious to water. The uplands bordering on these are of excellent quality for grass or small grain. In what way can the owners of such various grades of soil best improve them? How should they be managed? How can their fertility be most readily increased?

I will notice them in the order named—Alluvial, first in character and value, resting on the river front and extending to the wet land or slash. This is the most easily reclaimed if exhausted by cultivation. Nothing more is required than deep ploughing and grass. Sow heavily with clover, graze lightly, and use the scythe to prevent weeds from maturing. Feed hay, cornstalks or straw on it, and you will soon recover all its lost fertility. Your wet land presents two varieties, the one an open prairie pond, originally covered with water, the other clothed with timber. I believe the art of man has never yet invented any means of rendering such lands available to useful purposes without first draining. Water impoverishes as rapidly as cultivation. In vain will you look for the healthy action of plants on land saturated with water, or reap the ameliorating influence of frosts in pulverizing your soil and adapting it to the growth of vegetables.

Such land in every instance should be well drained, by either open or secret ditches, using such as your resources will most readily command. If only thrown up in beds in the direction of the slope, and the centre furrows well cleared, the surface water will pass off, adding much to the value and production of the lands.

Your open prairie ponds are exceedingly rich, abounding in vegetable matter, and, when thoroughly drained and acted on by the sun and frost, will yield most abundantly. I am convinced that the surface of all wet lands, when reclaimed, sinks, and these ponds more than any other, occasioned by a greater decomposition on their exposure to the atmosphere. Hence open ditches, that when first cut answered the purpose, will have repeatedly to be deepened as your land settles; for you need expect no permanent improvement until you have thoroughly commanded the water.

On the subject of wet land, and the great importance of thorough draining, I have never seen a better illustration of its happy effects, than an anecdote given by the late Judge Buel. "An acquaintance called upon a Scotch farmer, whose farm had been under-drained, and being informed that the improvement cost sixteen dollars an acre, till having been used, remarked that it was a costly improvement. 'Yes,' was the farmer's reply, 'but it cost a deal mair *not to do it!*' which he illustrated by pointing to an adjoining farm, like situated, which had not been drained, and was overgrown with rushes and sedgegrass, and then to his own fields teeming with luxuriance and rich in the indications of an abundant harvest."

Those elevated tables of sandy land, so common to the Ohio, many of which now look like the sterile and worn out fields of the lower part of the state, have once, as I have often been informed by the first settlers, been the most beautiful part of all our bottoms. Before the hand of man had thrown them open to the sun, they were carpeted with wild grass and pea vines, looking like some splendid park, with all its undergrowth removed, well stocked with deer. Settlements commenced, those lands were soon cleared; but the constant and immense demands for grain to supply the Kentucky drovers, impelled their owners to the ruinous practice of repeated and continued corn raising, until they have nearly exhausted the whole life blood from them, and will now require that mode of treatment which modern

science in improvement has taught will successfully reclaim their fertility.

I labored under a strange delusion when I first settled in this country. We have lands on our farm exactly similar to those I am now describing, and we then believed them almost useless, that in consequence of their open sandy character nothing could be done to restore them, where once exhausted, or even to make tolerable crops, when first cleared and brought into active use.

The best plan that I can devise for the benefit of the owners of such property, is to give our own experience, when placed exactly under similar circumstances.

I vouch for the accuracy of every statement here made, and would thank gentlemen to call on us and have an ocular demonstration of its correctness. When my connexion, Mr. Beale, first got possession of his farm, a tenant had previously cleared about thirty acres of his sandy land, and had then absolutely worn it out, the last crop of rye he sowed producing less than five bushels to the acre. The whole of this field was covered with running, and the fence corners filled with standing, briers; not one single spear of grass sprung up or made its appearance on any part of the improvements. He then possessed no other cleared land, all the balance of his estate being an entire forest. On this spot he placed his dwelling. And then the question arose with him, what was the first move to restore the fertility of this land? How shall I accomplish it? Where are my resources of manure to come from? The balance of my land is in woods, and I must make this land, by its own recuperative energy, spring into life and usefulness again.

He commenced operations by applying his strong horses to a good plough obtained from Pittsburgh, and breaking the soil deeper than ever his tenant had previously ploughed, sowed small grain in September with clover and timothy. Yes, timothy on that poor sand bank! Most of the seed grew. A sorry crop of grain followed of course, but his grass seed had fortunately taken well, and in that he saw the germ of future fertility. It was lightly grazed the first year; the scythe applied to the briers in August. His stock added by their droppings a powerful auxiliary well prepared.

That grass remained three years, subject to the same treatment, and was then turned under. A wheat crop followed, that, I well recollect, was abundant. Clover and timothy were again sown, with some green-sward that he obtained from Kentucky. By this time he had cleared some of his front bottoms, and commenced feeding his fodder from them on those exhausted fields, now well set in sod. This process of feeding in the winter, and mowing any briers or weeds that spring up in the summer, was continued until he left our country and passed his estate to his son. At that time those exhausted sandy fields were brought to such a state of fertility, that the green-sward had taken entire possession of all the clover and timothy, and was seen lodging in all directions over the field, having eradicated entirely the briers, leaving not one stalk as a memorial of its former desolation.

Now for the benefits and subsequent profits that his son has been enabled to enjoy, from the admirable course of treatment formerly given to this land. He ploughed all up, and took two successive crops of corn, each averaging at least fifty bushels to the acre. It was then sown in wheat, clover and timothy, giving a good yield of wheat, and taking well in grass, remaining but one year in sod, his fat cattle being fed on it in the winter. It was again turned over, and two more successive crops of corn, equally good, followed by wheat and grass. Continuing two years and fed on in the winter as usual, he last spring ploughed again for corn, and has at this time a crop almost sufficient to take the premium to be awarded on this occasion, at a minimum of one hundred bushels to the acre.

I must explain, that although the measurement has been made in the field of this sandy land, yet the spot measured for the premium was naturally richer ground than the general average of the remaining portion: but I have no hesitation in asserting, that at this moment, on an average square acre of land in the lot so previously exhausted, there is standing at least sixty bushels of corn to the acre.

You will observe by this statement, that after the renovation of the sand, six crops, of grain, (four of corn and two of wheat,) have been taken in seven successive years. Then follows three years in grass, and thus it is now again in corn, clothed with the best crop it has ever produced.

What think you now of worn out sandy lands? Do you believe you possess any more completely prostrated than that I have accurately described above? Are you willing to enter upon the career of improvement? If you are, here then is an example worthy your imitation, fear not the result. You have seen what judgment and preseverance has accomplished.

While on this subject, I will state another experiment now in operation on exactly a similar character of land. The growth was all black oak and hickory, the ground so porous and sandy, that in early times I have frequently taken my ramrod from my rifle and without difficulty thrust the whole in the earth. How would you undertake to make such soil yield its hundreds? Now for the process. The timber was all killed, the undergrowth taken out, sowed in grass seed and ripe hay fed over the whole, to form a good sod immediately. The land was then grazed with cattle, and fed over occasionally during the winters. In six years succeeding the girdling, when after the bark and brush had been principally torn off by the storms and trod in pieces under the feet of the cattle, all the standing timber was cut down and burned, and the whole mass of vegetable matter thus collected and now nearly decomposed, turned in with the sod last year.

What think you was the average yield of the first crop? I am sure at least sixty bushels to the acre. Hogs were then turned in, and consumed the standing corn on the field. The balance of the winter and part of the spring fattening cattle were fed on the same lot with cut up corn and fodder until the earth was nearly covered over with litter. All was again this season turned under, and at this moment there stands upon it a crop of corn, some shocks of which have been husked, showing a yield of upwards of seventy bushels to the acre. The same process is again

to be applied the ensuing winter, with this difference, that in the present year, the corn has been cut up and will now have to be removed and consumed on grass land adjoining, the cattle will then be put on, and other corn and fodder brought and fed in the same place. There are two lots of ten acres each of that character of land, kept as winter and spring feeding lots. It is intended to try fairly the experiment, whether they will not produce corn every year in succession, and continue to increase in fertility while under that course of management. Sandy land is well known to improve under the operation of treading, it compacts the soil, rendered more tenacious: and what would succeed with it, is death to clay, making it utterly useless until pulverized by frost.

I have made this statement for the sole purpose of bringing into public view, the true value of that character of land when judiciously managed.

I am not the operator; it has passed under my own eyes, and I only claim to have aided by frequent consultation in the first successful experiment, that once accomplished gave the key to the subsequent course now in progress of execution, the result of which you will learn at some future time.

There is below here, as well as in our own county, a large body of similar land, and wherever there is a connexion with some rich alluvial front bottom, you have the means at command to restore its original fertility. Our best lands, as before remarked, possess within themselves the germ of their own restoration; you gain it by deep ploughing, followed by grass. All their production should be removed and consumed on your secondary soil. You will then observe with pleasure the great advantage a small covering in winter will produce in succeeding crops, and the efficient aid it furnishes to enable grass to take root. Once obtain this powerful auxiliary in restoring exhausted, or retaining the virtue of rich soil, and time and judgment will accomplish all your require.

There is on every farm some peculiarity of soil and position, an endless change and variety of circumstances, daily requiring the use of skill and experience to convert them to practical benefit. I would therefore recommend, that the farming publications should be taken by every man who expects to make his living or his fortune by the cultivation of the earth, for through them he will gain the first requisite of his profession, food for reflection, deep reflection, seeking cause from effects.

My intercourse heretofore, with other parts of your county, enables me to sketch some of the prominent features of its soil and character. Pursuing our way to the south part, I find the lands on the various forks of the Twelve Pole, and particularly that portion about the divide of the sandy waters, well adapted to farming purposes. It may rank high as a grazing country, whenever the present occupants shall cease their scourging operations of raising corn on hill sides, and convert them into blooming luxuriant pastures.

There is no better index to the farming pursuits of a country, than is evidenced by the character of their stock thrown into market. In early times, the mountain range was the beneficent resort of all, and is now nearly exhausted, still no preparations have been made for pastures to take its place. Hence, every succeeding year the stock decreases in size, and will continue to depreciate until a new era shall cover every hill and every hollow with teeming grass for their support. Your soil and advantages will justify these remarks, and for the evidence of its practicability and success I may refer you to your neighbors in Kentucky.

In examining the Guyandotte and some of its tributaries, I find that its bottoms have been exceedingly rich and productive, but that the same temptation to over cropping in corn, occasioned by the high prices obtained on the road, could not be resisted, and they have continued the suicidal policy of corn after corn in rapid succession, until they are now left with a diminished return of scarce half its original production.

Can it be good policy in any farmer thus to persist in an operation, that yearly lessens the remuneration of labor? I should think not. How will you remedy the evil? What course of husbandry should be adopted?

Some will contend that it is necessary to keep all their good land in corn, and that, even, if only one third should be laid down in grass for improvement, the balance will not yield sufficient for their consumption. Can you think of no plan to save this depreciation for a year or more; or to stimulate the two thirds in cultivation to produce what you now gather from the whole?

Reflect, have you no manure at command? Is there none to be obtained in this village? Can you not quantity the amount in your barn yard, sufficient to cover over one half of your corn land? And if thus enriched and well cultivated, may you not reasonably expect a return adequate to your demands, while your grass is restoring the balance.

A Pennsylvania German, or perhaps an eastern farmer, would find a resource in the alluvial deposite on your banks, which when applied to his corn land would keep up its fertility, until time was gained on the other for its restoration by grass. The tributary Mud river has suffered much from the same course of management, and its fertility materially affected from similiar causes. I saw there, in several places immense amounts of rich alluvial deposite, which if properly applied would be held in high estimation.

Pursuing the road through Teay's Valley, it presents some singular geological features, and were I now in search of hypothesis and proof to sustain the igneous action of the Huttonian theory, from the energy of internal fire and upheavings of the crust of the earth, I know no place near us that affords a finer field for the display of the imagination, or that presents stronger evidences of some great and wonderful alteration from its original position. How shall we account for the river rocks, rounded by attrition, imbedded in sand and pebbles, placed on an elevation two hundred feet above the level of the Ohio? How for the stratified rocks changing their angle of inclination? The inference is irresistible, that it has at some period been the bed of a lake or river, and that some convulsion has raised the earth and compelled the water to seek its course to the ocean through other channels. But enough of this; my business is with the surface as now existing, and

the use to which its occupants are converting it.

This valley on its first settlement must have presented a beautiful and attractive appearance. It abounds in springs, is gently undulating, only swelling in vales sufficient to carry off its redundant waters. Here too are seen the evil effects of severe cropping, reducing parts to an almost hopeless waste; but the hand of desolation will be arrested, for the march of improvement is onward and progressing. The attention of the traveller in passing is arrested by the evidence of what zeal and energy can accomplish. A worthy and enterprising member of our society, recoiling from the desolating course of his predecessors, and bursting through the shackles of an exploded system, has set an example of improvement that well entitles him to be hailed as a friend to the best interests of his country. I hope no apology is needed for this public expression of my approbation where I think it so justly deserved. There has been another example of successful improvement in the upper part of the valley, on a different character of soil, that was much admired for a period, until finally blighted and extinguished.

A gentleman, now a resident of Mason and then the owner of that estate, who was remarkable for his energy and industry, was the first to clothe a naked soil in all the blushing glory of rank and luxuriant clover.

He sold the property, and since then other councils and other plans have been pursued. I lately passed by that estate, and really it seemed to me, that some southern sirocco had swept over it, its devastating influence, withering and parching out every vestige of that beauty, which was the delight and admiration of all who saw it. I have now taken a cursory view of parts of your county, pointed out some facilities at your command for its improvement, and would finally say to those who are reviving their exhausted lands by grass—go on, increase the quantity sown until you cover all not required for the plough. Your example will eventually be followed by those who are desirous to share with you the rich reward you will certainly reap. Continue to inclose your wood land—cut out the under brush, sow it thick with seed. A good example is furnished you, by a countyman, a spirited member of our society, who has now thousands under fence, and every revolving year is adding to his almost unlimited means for extension.

A LIST OF PREMIUMS

Awarded at the annual meeting of the Mason, Cabell and Kanawha Agricultural Society, held in the town of Guyandotte, on Thursday, the 11th November, 1841.

To Gen. P. H. Steenbergen, bull *Rockingham*, Durham,	$20 00
James Shelton, 1 year old bull	8 00
Dr. Benjamin Brown, bull calf	5 00
George Moore, cow	10 00
Sampson Landers, 2 year old heifer	5 00
Washington Shelton, 1 year old heifer	5 00
John Morriss, stallion [by Greybeard]	10 00
James Y. Quarrier, 2 year old colt Prince Albert	7 50
Dr. Benjamin Brown, 1 year old colt by Sir William	5 00
J. Y. Quarrier, brood mare, dam of P. Albert	7 50
John Morriss, sucking colt by Young Grayb'd	5 00
Roman Manager, Berkshire boar	5 00
A. L. Doolittle do sow	5 00
Joseph Nagle, ram, Bridgewater	5 00
do ewe do	5 00
John Capehart, acre of corn, 114 bushels 7 qts*	25 00
John Morriss, acre of meadow, 6482 lbs. timothy,	10 00
John Capehart, best sample tobacco, (very good)	10 00
Mrs. Frances Moore, of Mason, domestic carpet	10 00
Mrs. Lucy Matthews, of Kan'a, rag carpet	5 00
Mrs. Sarah Doolittle, of Cabell, pair blankets	5 00
Mrs. Frances Moore, of Mason, piece of flannel	5 00
do do piece of jeanes	5 00
do do fancy bedquilt	5 00
Miss Olivia Holdridge, of Cabell, silk stockings	2 50

Articles for which premiums were not previously awarded, but pronounced by the judges highly deserving attention:

Mrs. Lucy Matthews, a very fine silk shawl, grown, spun, and manufactured by herself.

Miss Abigail S. Adam, of Cabell, a rich hearth rug and 2d best quilt.

Miss Sarah Poor, of Cabell, a fine woollen shawl, 5.4 square.

Mrs. Sarah Couch, of Mason, a rich toilet cover.

Miss Johanette Magnes, of Cabell, four infant net caps, very rich; and best piece of cotton hose.

Miss Leonora Chapman, of Cabell, the best specimen of sowing silk.

Mrs. Mary A. Nixon, of Cabell, a very fine palm leaf hat.

Ambrose L. Doolittle, three barrels cocoons.

Miss Julia A. Wright, of Cabell, presented a very fine speciman of race ginger cultivated by herself.

SILK CULTURE IN EAST TENNESSEE.

From the Tennessee Agriculturist.

The following extract handed us by a friend, from the most experienced silk culturist in Tennessee, we hope will be interesting to many of our readers:

Rotherwood, January 4th, 1842.

Dear sir:—In reply to your questions on the progress of the silk culture, &c., I remark, that notwithstanding the gloomy aspect of moneyed matters for some time past has deterred from all adventure, the silk business is now in a fairer

* There were three other competitors for this premium: Samuel L. Alexander produced evidence of having raised 112 bushels to the acre; Charles Beale 101½, and Morgan Moore 100.

way of success than at any former period. I have bought between $1500 and $2000 worth of cocoons the last year, and have reeled between 300 and 400 pounds of silk, which I have sent to Philadelphia, and am now waiting the result of sales of a large part recently sent. The feeding of worms the last season in East Tennessee was highly encouraging, although there were some failures. I have now no doubt of its being a branch of agriculture with us of no small ultimate importance. I was not so successful in feeding as some of my neighbors, owing I think principally to the dampness of the dirt floor to my shed. I have tried Mr. Morris' plan. There is nothing essentially new in it, and I do not like it. I have no idea of its general adoption. I have tried many ways of feeding and am not yet decided which is the best of several. I am rather in favor of the Turkish mode, viz: to feed with the branches piled on, the higher the better, never clean at all, and permit the worms to spin in the branches. This I believe the cheapest way. The cocoons are equally good and the fixtures of trifling cost. Indeed the floor may do for the first shelf. I ought to say, however, that the most successful feeding last season was on solid shelves and with the plucked leaf. I do not deem the question settled between these modes; because the Turkish plan has not been as fairly tested as the other. You can obtain peanut eggs of the best variety next spring by writing to me. Price I suppose about $5. Yours, respectfully,

FREDERICK A. ROSS.

AN ESSAY ON GRASS CULTURE.

For the Farmers' Register.

The cultivation of the grasses has but recently received much attention, in what is usually called eastern or lower Virginia. In this section of country, almost the sole dependence for provender has been on the offal of corn. Indeed the general opinion, until within a few years past, has been, that the grasses would not succeed well among us. How this opinion became so general, and why it was so long continued, I am at a loss to conjecture; for it is a fact, that in this portion of country there are vast quantities of land admirably adapted to this crop, whilst at the same time they will produce no other. Such lands have therefore hitherto been useless and worse than useless; for instead of adding to the value of our farms, they have only marred their beauty, and furnished so many eye-sores on the same. Of this kind were all the spring branches, and other streams, and marshes and low sunken places, which were permitted to remain in a state of nature, and to luxuriate in all the varieties of their own spontaneous productions. It seems never to have occurred to our worthy ancestors that, simply by ditching these places, the superfluous waters might be drawn off and in this manner rendered the most beautiful and valuable portions of their farms: but the son received the estate, just as it was transmitted to him by his father, and he in his turn, left it to his son in all its natural deformity.

But I am happy to say, that a spirit of improvement begins now to manifest itself among us. Whether it is that the high lands are so exhausted, that they will no longer furnish a support, or that an unwonted impulse has been given to this matter by means of agricultural societies and agricultural publications, the fact is that a great change has taken place for the better. People now begin to feel and to appreciate the value of grass crops; and they will admit that they never knew what it was to live in plenty and comfort, till they had an abundance of hay for their stock. Instead therefore of long lines of unreclaimed land on both sides of streams, instead of large bodies of sunken land covered with stagnant waters, sending forth pestilence and death every fall, these unsightly places are reduced to beauty and order. The water which was formerly permitted to spread abroad, the habitation of filth and disease, is now restrained in narrow ditches; and the lands which once produced nothing but bulrushes and other pests are now covered with rich crops of nutritious grasses. This beautiful state of things, I am sorry to say, is as yet just in its embryo among us. Much, very much, remains yet to be done. A few enterprising individuals, scattered here and there, in our widely extended waste, have showed this noble example. A mere *beginning* however has as yet been effected, whilst thousands and tens of thousands of acres are still in all their natural deformity. It is with the view of correcting this great and sore evil, that I write this essay; and if by means of it one single ditch is dug, or a single acre is reclaimed and brought into successful cultivation, I shall feel myself amply compensated for my trouble.

With these introductory remarks, I proceed to consider,

1st. Which of the various grasses it is most expedient to cultivate; and,

2d. The peculiar cultivation which experience shows is best adapted to success in this crop.

Of grasses there are a great many varieties, amounting to some hundreds and perhaps thousands. It is not my object to ascertain their precise number; nor is it my intention to present the few that I shall notice under their various botanic names. In fact, I intend this as a simple plain treatise, which, by the use of common names and the most common language, will be perfectly intelligible to every one.

It will be conceded on all hands, that of the very great variety of grasses, comparatively very few are of any special value. The great majority of them, however important to cover the land, and to furnish food in their tender state, are of no value whatever as a crop. Indeed most of them can be regarded in no other light than as mere pests, and therefore are to be ranked among thorns, briers and thistles, with which the earth was cursed, in punishment for the sins of mankind. These are so well known, that I consider it wholly unnecessary to point them out. But among the numerous family of grasses there are a few which, upon trial, are found to be of very great value. Of these, the common red clover deservedly claims the first rank. This grass is especially valuable on several accounts. When properly managed (of which more hereafter) it certainly makes a most nutritious hay, of which stock of every kind are very fond, and on which they thrive remarkably well. In addi-

tion to this, it is found to be the very best enricher of land when turned in, in a green state. All crops thrive well on a clover lay. The best crops of wheat and corn are uniformly taken from the clover fields. Indeed, the farmer considers his work as pretty well done when he can get his land in a state to produce clover freely. It not only throws forth large quantities of nutritious stems and leaves, but each plant has a long tap root, which penetrates to a great depth; so that the whole land, both above and below the surface, is completely occupied with it, and many are of the opinion, that the root contributes as much nutriment to the land as the top. This grass is rendered, in many situations, especially above tide-water, vastly more luxuriant by applications of small quantities of gypsum. Two or three bushels to the acre, applied in early spring, are often found greatly to increase the crop. In eastern Virginia, however, lime or marl, or ashes, is a much safer reliance. If alkalies be present in sufficient quantities, it will succeed well in almost any soil, except it be too wet, and when it has taken a firm hold, it is almost impossible to eradicate it. I have known seeds to vegetate after they have lain dormant at least ten years in the land. One sowing on good land, kept in a state of constant fertility, is ordinarily sufficient for all time.

The next grass which I propose to consider is what is commonly called the Kentucky blue grass. No doubt seems now to exist, that this grass is identically the same with that which abounds so much in all rich soils, throughout our whole state, and is known among us by the common name of green-sward or blue grass. There is however a difference, between these two grasses; but it requires a botanist to point it out. In a practical treatise of this kind, this difference is of very little consequence.

This grass, to the western farmer, is of immense importance, not on account of the crops of hay which it yields, but the rich pasturage which it furnishes. It is indeed one chief source of the western man's wealth. The time has been when New England was considered the best grazing country in America. The best cattle were found there, and large numbers of mules were exported to the West Indies. But since the introduction of this grass into the west, Kentucky and Ohio have evidently taken the lead. There is no doubt that these two states now furnish a larger number of fine animals than any other section of our country. Large numbers of horses and mules, great droves of cattle, and still greater droves of hogs, are driven every year from those states to find a market in the east. And all these animals depend, in a great measure, upon this rich nutritious grass.

And here it is a subject of interesting inquiry, may not this rich grass be turned to a profitable account among us also? It has already been remarked, that it grows every where in our state. I have seen it on the mountain top, and in the valley below. It succeeds well in all rich soils, both above and below tide-water. A fertile soil then is the only thing that is wanting to ensure success. Now it has occurred to me, that those farmers who have more land than they can cultivate (and great multitudes are in this situation) might turn their superfluous lands to great profit, by getting them well set in this grass. If the means exist, the process is a very simple one; and if the means do not exist, no farmer ought to rest satisfied till he has them. But it is not my intention to enter on that broad and extensive subject involved in the improvement of land. I would simply observe, that where marl exists, (and it abounds almost every where in lower Virginia,) stop up the gullies, if there are any, grub up the young pines and other rubbish that has taken possession of the worn out old fields; plough *deeply*, then cast on the marl; sow clover seed and harrow them in, and a foundation is at once laid for improvement. In two years, the clover will in a great measure disappear, and the green-sward will begin to take its place. The probability is that in many parts of the field there will be neither clover nor green-sward. Such places require further aid. But by persevering in this course, the whole field may ultimately be reduced to fertility and beauty, and in time the whole farm may be greatly improved.

But what is to be done when marl cannot be procured, and where the crops require all the manure that can be commanded? The only remedy in this case is *to make more manure*. Nor let any one say that this is impracticable. I venture to affirm, that not one in fifty among us makes *half* as much manure as he might and ought to make. The plan is simply this: increase your crops; this will enable you to increase your stock, and then a foundation is laid for increased manures.

It will be perceived that the above remarks apply only to those who have superfluous lands. It is obvious that all such lands are vastly more valuable in pasture, than to remain as exhausted old fields.

But in this section of country, and especially in the neighborhood of our towns and cities, there are also many small farms. Here it would be very bad policy to devote much if any of our lands to mere grazing; and here the green-sward, instead of being a blessing, is a mere pest. In all *tillage* lands, as a general rule, it is an unwelcome visitant. This is particularly the case in all the meadows in which we wish to cultivate the artificial grasses. There it is one of our greatest plagues, for such is the tenacity of its hold, and such is the rapidity with which it spreads, that it speedily displaces every thing before it. But as a mere pasture grass, I believe that its equal, both in firmness of sod, and richness of nutriment, is not to be found in the whole catalogue of grasses.

Some time ago I was much amused, and I hope profited, in looking over an analysis of the grasses made by Dr. Darlington, of Pennsylvania, in which he gives the first rank in point of nutriment to the Kentucky blue grass. Next in order he places what we call timothy, but in New York, and east of it, it is called herds-grass. This is certainly one of our most valuable grasses. None is more certain to vegetate when the seeds are good, and proper care is taken in the preparation of the land, nor is there any that comes to a more speedy maturity. If sowed in the fall, say in September, on good land, it commonly produces a good crop the next season. It may also be sown in the spring, but then it will not produce a crop until the next July twelve months. There

is however some economy in this, for an intermediate crop of oats may be taken from the same land. But the spring sowing, especially if the summer should be hot and dry, I have more than once found a precarious dependence. The fall sowing is upon the whole rather to be relied on.

Herds-grass, called red top at the north, is slower in its growth. It requires a longer time than timothy in taking a firm hold on the land, but when once well set is more hardy, and will ultimately dislodge it. It may also be sown in lower and wetter land, and will maintain a longer struggle with blue grass, broom straw, and other pests. My practice has therefore been to sow a mixture of these two grasses, say two-thirds in measure of timothy to one-third of herds-grass. The result is, that at first the timothy, being most rapid in growth, is the prevailing crop; in the second year, the two crops are about equally balanced; but in the third year, the herds-grass greatly prevails. Until I saw the analysis alluded to above, I was in the habit of considering herds-grass as valuable or even more so than timothy. You may imagine my surprise, then, when I saw my favorite placed *seventh* in order. This shows how little dependence is to be placed on mere appearances, and how necessary science is to correct our false impressions.

Another grass, to which Dr. Darlington gives a high rank, placing it third in order, is called the orchard grass. This grass is principally valuable on two accounts. First, it grows well on high and even light lands. I once saw a fine crop of it on a gravelly hill-side, and the proprietor told me that it was ten days in advance of his lucerne, so that it furnished the earliest green food for his cattle. And, second, it is certainly the very best grass to intermix with clover, both coming to maturity and both requiring harvesting about the same time; whereas clover is three or four weeks in advance of timothy or herds-grass.

There is still another grass, which in a treatise of this kind ought not to be entirely overlooked, called the Peruvian or highland meadow oat. It grows to a great height, the seed are very abundant, and the product a very prolific one; but the hay is coarse, and generally not much relished by stock. Of this and a great many other grasses I shall say nothing more, because, although valuable on many accounts, they are so inferior to those enumerated above, that I cannot advise their cultivation. I have now dwelt long, perhaps too long, on the first branch of my subject. I need scarcely inform the reader that I am very much opposed to long speeches or long sermons, and equally opposed to long essays. But really I cannot see any thing in the above which ought to be retrenched. I proceed therefore to consider,

Secondly, The peculiar culture which experience shows is best adapted to success in the grass crop. And here the first thing which claims our attention is the most suitable situation. In general, low and moist lands, such as swamps and marshes, and the sides of streams of water, after being well drained, are selected for timothy, and especially for herds-grass. There is no doubt that, with a favorable season, these crops are very abundant in such situations. But there is another which is still more favorable, and that is, where a stream of water may be conducted along a slope, from which frequent little rills may be drawn off, so as to irrigate the whole. In such a situation we may almost bid defiance to the season. It is a fact, well known to every observer, that these crops grow more in the month of June than in all the year besides. It is also well known, that at the time of heading they require a good deal of rain. If, therefore, June happen to be a dry month, the crop must necessarily be curtailed. Hence the great advantage of irrigation.

But, besides these low situations, I have known heavy crops of these grasses to be taken from high lands. If, in fact, the land be tolerably level, rich, well prepared, abounding so much with clay as to form a loam, I would not hesitate to sow timothy, herds-grass, clover, orchard grass, or the Peruvian oats, any where. I have been cultivating the most of these grasses for the last fourteen years. I have had them in every variety of situation, and, with the exception of one year only, I have never failed in having a tolerable crop.

The next thing to be considered is the necessary preparation of the land. And here (if I may be allowed the expression) no crop so peremptorily insists on good treatment as the grass crop. Without good land and good preparation, the labor, and time, and seed are all thrown away. With good management the reward is liberal; but without it there is no reward, but in lieu a positive loss. If therefore the situation be high, and consequently requires no draining, all you have to do is, by frequent ploughings and harrowings, to reduce the land to the finest tilth. Nor let any one feel that he has fully done this, until his whole preparation is made to resemble a square in his garden, well spaded and nicely raked over. If the situation be low, and the water inclined to stagnate, the first and most important thing is to drain it; for of all enemies to the artificial grasses stagnant waters are the most pernicious. In a general treatise, like this, it is impossible to lay down any set of rules that may be appropriate to every particular case. To do this, one must first view the spot and mark its locality. But, as a general rule, there must be an open ditch, proportioned in its depth and width to the quantity of water to be passed off. And although there is great symmetry and beauty in a *straight* ditch, still I would, if necessary, sacrifice these to practical utility. I would therefore conduct the ditch along the *lowest* places, though in doing so it should be somewhat crooked. Into this open and main ditch, all the water should be conducted by drains, or other small ditches, until the whole is drawn off. And here, for reasons which, I take it, are obvious to every one, I would strongly recommend *under-drains*, in all instances where suitable materials can be commanded. I have in my time made many miles of under-drains, but having no stones or other durable materials, in three or four years my drains became stopped up, and therefore useless. At present, therefore, I am compelled to resort to surface draining, a process with which I am by no means pleased; for, besides being a slovenly affair, it is attended with the loss of much valuable land. Draining, however, must be done, and in effecting it every one must be left to his own convenience and taste.

The water being now removed, the next thing is to plough and harrow until the whole is thoroughly pulverized. How often these implements ought to be used will depend on circumstances.

Three times I generally find to be sufficient. But in these low situations, I could never yet dispense with *beds*. Water furrows I have found absolutely necessary to collect the water, from which it is drawn off by means of cross drains. We will now suppose that every thing is prepared as stated above, the water drawn off, the land bedded and in fine tilth: the next thing is to sow the seeds. The best time for this, as I think, is from the middle of September to the middle of October. For this purpose a careful hand ought to be employed, who will scatter the seeds evenly and equally over the whole surface, giving to each spot its due proportion. A calm time must therefore be selected, for if there be much wind, many of the seeds will be wafted away, and the evenness of the crop destroyed. I have already stated that I prefer a mixture of timothy and herds-grass seed, and I have given the proportions. Of this mixture, I consider a half bushel as sufficient on good and well-prepared land, and if the land is not good and well-prepared, even twenty bushels nor any other quantity is enough. And whilst upon the subject of sowing, allow me to say, that two quarts of clover seed, or a bushel of orchard grass or Peruvian oat, is about the proper quantity to the acre. I take it for granted, that no one will understand me as advising to sow *clover* in the fall. These seeds are usually sown with small grain, with wheat or rye in February, or with oats in early spring. The seeds being now sown, other important parts of the work remain to be done. The first is to pass a heavy roller over the whole, then to clean out the water furrows and the drains, and lastly, if possible, to give your meadow a top-dressing of good manure.

But some one will say, if I am to have all this trouble and expense, then the hay crop will be like the Indian's gun, "cost more than it comes to." But let us try this a little. I think the hay crop the very cheapest we can raise. The outlay, I acknowledge, is very heavy; but it ought to be recollected that we are laying the foundation not for *one* crop only, but for at least three, and sometimes as many as six. But we will content ourselves with the lowest number. Now to procure these three crops, we plough and harrow three times, and we roll and manure once. But in getting three crops of wheat, how often do we have to plough and harrow? At least *six* times, and each crop ought to have its rolling, and would be much better if it had its manuring. Three grass crops, therefore, are produced with one half the labor and with one third the expense in manuring. But let us try it in comparison with the corn crop. And if any one gets a corn crop, including the preparation of the land, with less than four ploughings and two harrowings, besides other work with the hoe and cultivator, then he has a mode of doing business of which I confess myself ignorant. To get three crops of corn, therefore, we must plough *twelve* times, and harrow six times, besides doing other labor. Which, then, is the most laborious crop?

But in a discussion of this kind, other things are involved besides the actual amount of labor; for if the increased labor produces a proportionable increase of profit, then things remain just where they were. If I labor more I get more for it; and if I labor less, my profits are proportionably curtailed. Let us test this matter also. An acre of land, such as I have described, will ordinarily produce 3000 lbs. of hay, oftener more than less, but we will fix on that as our standard. An acre in wheat scarcely ever exceeds 20 bushels, generally falls below it; and an acre in corn generally falls short of 8 barrels. But we will fix on these two numbers as the standard. Hay in my neighborhood and in the vicinity of market towns generally is worth $1 per 100 lbs.; wheat in the same circumstances is worth $1 15 per bushel, and corn $3 per barrel. If either be remote from market, the profit is diminished in proportion to the expense of transportation. According to this, the acre in grass, with its three crops, will produce $90; the acre in wheat, with its three crops, will produce $69; and the acre in corn $72. But here is an important fact to take into the estimate, that the $69 for wheat has cost me twice the amount in labor, or the $72 for corn four times the amount of labor, as the $90 for hay did. The result is that less labor has produced the most money. Ought any one then to be alarmed in putting down his lands in grass?

But there is another important item which ought to come into this calculation: which crop, continued for three years, is least injurious to land? Now I will not assume, as many others have done, that the cultivation of the grasses, so far from being injurious, is actually beneficial to the land. I will admit that grass, with every thing else when the product is removed, is an exhauster. But I believe that it has never yet entered into any man's head that grass exhausts as much, or any thing like as much, as corn or wheat. If then grass, with one half or one fourth the labor, will produce much more money, and at the same time exhaust the land much less, then, as an act of sound economy, I must stick to the grass.

But I am tired of writing, and I doubt not the reader is tired also; but I feel that this treatise would be unpardonably incomplete were I to say nothing as to the proper time and mode of harvesting the grass crop. This is a matter of much more importance than farmers are generally aware of; for on it depends the flavor, the nutriment, and therefore the whole value of the crop. And here I shall perhaps advance some things which may be controverted by others. My observation may come in conflict with theirs. But all I have to ask is, "give me a fair trial before you hang me." I say then, in general, that our grasses are allowed to stand too long in the field before they are cut, and that they are allowed to remain there too long before they are carried to the mow. The proper time to mow the clover is when the blossoms *begin* to change from the red to the brown state. The stems and leaves have then come to full maturity, containing all their sugary and other nutritious properties, and the after process is merely employed in ripening the seed. Unless harvested now, the stems lose their juices and become hard, and the probability is, that in curing, most of the blossoms and many of the leaves will drop off, and instead of that sweet, fragrant substance, which alone deserves the name of clover hay, you will have only a parcel of dry, black sticks. The other grasses ought all to be mowed as soon as they have dropped their bloom. Indeed, when the crop is a large one,

a beginning ought to be made whilst they are yet in bloom; for, unless the force is a large one, and the season favorable, some will be advanced too far before it falls under the scythe.

As a general rule, no grass ought to be mowed whilst it is wet. Even a dew will injure it, and a shower of rain much more; nor ought it, if possible to prevent it, ever to get wet after it is mowed. The best plan is, to stir the grass as little as possible. In good weather, there is no need of disturbing the swaths, but let them lie for a few hours, until the top is wilted, then throw them into the wind-row, taking care in doing so to bring the bottom to the top, and it is surprising how soon the whole mass will be cured. I have several times had grass cut in the morning and before night it was under the shelter. In bad weather, this is a difficult crop to manage. In this event, all that we can do is by shocking to protect it from the wet as far as possible. My rule is to have as little in the field as possible. When therefore we begin the harvest, as soon as any portion is fit to put away, it is immediately deposited under the shelter, and after this we cut only as fast as we can take care of it. If therefore a rainy season should occur, no large amount is in the field, and no great loss can ensue. In good weather the process is a simple and beautiful one. A certain number of hands are employed in mowing. These are followed by another set who wind-row the grass, or pile it up as soon as cured; and these are succeeded by a third set, who carry it to the stack or shelter. Thus the whole process of cutting, curing and storing away, goes on at the same time. But the quantity cut should always be regulated by our means to take care of it.

EXTRACTS FROM THE PROCEEDINGS OF THE WENTHAM (ENG.) FARMERS' CLUB.*

At the following meeting, the subject was, "On the application of nitrate of soda, and its effects as a manure." The member introducing it, related the following experiment he had made as applied to wheat:—

"March the 12th, 1840.—Sowed nitrate of soda at half a cwt. per acre on about half a field—missed two stetches, then sowed the remainder of the field with a cwt. per acre. On the 23d of May, the land sown with the half cwt. only was again sown with half a cwt. per acre more, excepting one stetch, still leaving the two stetches without any; in a few days a great difference was perceptible, both in color and strength of the wheat between the land sown with nitrate and that not sown; and there was also an evident difference in the stetch sown with half a cwt. only, being much paler in color, and not so strong in plant as the land sown with the cwt. per acre—and so continued till harvest. At harvest, measured one-third of an acre from the two stetches left unsown, and the same quantity from two sown stetches adjoining; each crop was harvested and thrashed separately, and the result was, an increase at the rate of five bushels and seven pints of wheat, and two and a half cwt. of straw per acre on the nitrated part above that not nitrated. This experiment was made on light land, a pea stubble mucked for the wheat, which lost the color very much in the dry month of April, and became very weak in plant previous to the nitrate being applied, but improved very rapidly afterwards."

He had also applied it to barley and oats, without receiving much benefit, and is of opinion that applying it to land of a deep staple and already in a good state, likely to be injurious, by producing too luxuriant a growth of straw, and tending to injure the quality of the grain without increasing the quantity. In corroboration of this, another member related an experiment he had made on a good mixed soil for wheat, in which the crop on the land not sown with nitrate exceeded that which was sown by six bushels per acre, the land all treated alike previously; there was also less straw, (a circumstance not easily accounted for) and the wheat not so good in quality on the nitrated part of the field. Several other statements were made, in which its application had been attended with success, on lands varying from a poor light soil to a strong clay; in an experiment on the former description of land, the increase was at the rate of sixteen per cent., and in another, on a clay soil, an increase of about fourteen per cent. was obtained—the straw on the nitrated part was also six inches longer than where not nitrated. Instances of its successful application to clover layers, and also to grass lands were stated; in the latter case, stock were found afterwards to eat down the coarse places where it had been applied. The following resolution was adopted:—

> Resolved—"That on lands to which it is applicable, nitrate of soda has the effect of stimulating the plant, by which means more straw and an increased quantity of corn have almost invariably been obtained. From the statements made, the wheat crop appears to derive most benefit; but on rich soils, and those in a high state of cultivation, its application has been found injurious to the quality of the grain, and the quantity not increased. It is therefore the opinion of the meeting that strong clay and light soils are the most adapted for its use." * * * *

"The proper application of farm-yard manure, with regard to those crops to which it can be most beneficially applied," was the next subject which engaged attention. The member introducing it, after observing the great importance attending a judicious use of animal manures, and that much would at all times depend on the nature of the soil to which it was applied, contended, that on strong and mixed soil lands it was most essential to apply manure extensively for the root and bean crops;

* The papers from which the following extracts are made offer an excellent example to all agricultural societies. The report of proceedings is but the substance of *farmers' conversations*. Such verbal discussions, conducted with due preparation and order, by the members of any agricultural society, or farmers' club, and the results reported, would alone serve to change even one of the most useless bodies of the kind to the most interesting and useful. We have often, and in vain, urged the commencement in Virginia of this easy and agreeable plan of collecting and diffusing the opinions and experience of farmers.—Ed. F. R.

and as regards the latter, this system had the effect of benefiting the following crop of wheat on lands of that description. On light soils, it was considered decidedly preferable to be applied immediately to the wheat crop, and only a small portion for roots, as it was believed on such lands a heavy manuring for wheat was in some measure beneficial to the succeeding crop of turnips.

Manuring young layers* was often hazardous, and not recommended as a system desirable to be adopted to any extent, except on good lands, as when applied on lighter soils it was frequently found to be productive of little or no benefit in a dry summer.

One member who preferred carrying his manure for wheat, considered it desirable to be applied immediately after the hay crop is carted, as manuring thus early tended materially to strengthen the flag, but an objection (of much importance to a flock farm) was raised to this practice, as sheep would not readily eat the herbage afterwards. On this subject the meeting came to the following resolution :—

> Resolved—"Although no fixed plan can be laid down as to which are the most suitable crops for applying farm-yard manure, a great deal always depending on seasons and the nature of the soil; but from the remarks made, however, the meeting is of opinion that on good mixed soil and heavy lands it is highly desirable to manure well for the root and bean crops; but that on lighter soils, and where it is not considered right to manure extensively for roots, most benefit will arise by applying it immediately to the wheat crop rather than to maiden layers, which latter system the meeting does not consider it desirable to adopt, except on lands of good quality and kind for clover."† * * * *

The following meeting was engaged in a discussion on "subsoil ploughing with regard to its utility and practical effects." This subject, as recommended in the report of the preceding year, now came under the notice of the club, for reconsideration. The member who brought it forward observed, that the opinion he entertained at the former discussion of the question was not confirmed by the practical results he had witnessed during the eighteen months which had elapsed since this subject was before the club, as where he had used the subsoil plough the crops were not improved, neither had the deep-rooted weeds been eradicated as he had anticipated; the only benefit he had derived, was by getting rid of the surface water sooner, from the easier access given it to escape to the drains.

Another member, occupying mixed soil and very light land, had subsoiled his entire farm as it came for fallow, leaving a small portion in each field unsubsoiled, but without perceiving any decided advantage, excepting that where he has subsoiled there is less labor in ploughing than before. Other instances were given, where the subsoil plough had been used, without any beneficial effects being perceptible; one case only was mentioned in which it had proved of any advantage; on a piece of pasture land recently brought into cultivation, and previously drained and subsoiled, it had been attended with success, although it was inferred that the draining as well as the subsoiling tended to produce this result. The disappointment of members was general, as it was believed to be of no use where the subsoil is of a sterile nature, but requiring a greater quantity of manure to render it productive, fully proving that on lands where it has answered, a better soil was in some measure brought into action than before. The following resolution was ultimately passed, still leaving the question open for any light which may eventually be thrown upon it.

> Resolved—"As far as the experiments have gone in this neighborhood, no pecuniary advantage has resulted from the use of the subsoil plough; at the same time, the meeting does not consider itself possessed of sufficient information to come to a satisfactory decision on the subject."

"The breed of cattle best adapted for grazing purposes," was a subject occupying the attention of the club in September. The member introducing it having had many years' experience in grazing Scotch, Devon, and short-horn bullocks, at one time was in the habit of grazing the former kind, but considers the beasts now obtained from Scotland to be generally of an inferior description; they must also be bought at a higher rate than others. A well-bred Devon is a good beast for grazing, but he prefers the short-horn breed to either of the above kinds, as he has generally found them to make more growth, and also to possess superior fattening properties. The consumption of food by a short-horn was undoubtedly greater than that of a Scot, but the increase obtained in size and weight by the former fully compensated for the extra food consumed. In a trial made by another member between these two breeds, it was ascertained that the short-horns consumed five bushels of turnips per day, and the Scots but three; the short-horns, however, grazed decidedly the fattest, so that there was but little difference in the end. Herefords were noticed as possessing much disposition to fatten, but of these there was not sufficient experience to judge, as they are not much grazed in this neighborhood. The meeting adopted the following resolution :—

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* Recently sown grass-lands.—Ed. F. R.

† While presenting this opinion of practical farmers, we must protest against its soundness, at least for this country. Experience and observation have concurred with reasoning to convince us that it is better to apply manure as top-dressing to grass (clover) than to grain crops, and the more so as it is the less rotted or reduced. And though knowing but little of root culture, we should deem it far better to give to roots, and all succulent crops, manure in proper condition for their use, than the same to the grain crops; the latter kind being, in general, the last on the farm to which we would advise the applying the farm-yard manure, if the application to grass and to roots, vines or pea crops, were as convenient. Manure increases the stalk and leaf, and the tuberous roots of plants more than their seeds; and therefore should be given especially to those crops of which it is desired to increase the general bulk, and not to those of which the seeds alone are the important or sole object of product.—Ed. F. R.

Resolved—"That the short-horn breed of cattle is the most approved for grazing purposes, from the circumstances of their making more growth, and also possessing greater fattening properties than the other kinds; and although found to consume more food, this has generally been compensated for by their fattening in a shorter period."

The following meeting was engaged in a discussion on "The breed of sheep best adapted to this district, combining weight and quality of fleece with aptitude to fatten." The member bringing this subject before the club contended that, for all purposes, the pure Southdown breed was in every respect to be preferred. As regards a cross, that between the Down and Leicester was undoubtedly the best, but not equal to the pure breed of the former. The quality of the mutton of Down sheep was superior to that of any other breed (the Norfolk excepted), and generally obtained the highest price in Smithfield market; he believed they would make a better return to the grazier, and instanced a case of Downs and half-bred Leicesters having been bought from the same flock and kept together; the Downs beating the Leicester considerably. He thought there had not been that attention paid to the improvement of the breed of Southdowns which there had been to that of the improved Leicesters. Crosses between the Norfolk and Southdown, and between the Norfolk and Leicester, were also noticed, but not considered equal to the pure Southdown, requiring longer time to fatten, and when fat not so saleable as the latter. The Down wool was equal in quality to any other, and if kept well, will clip nearly as much as a cross-bred sheep.

On the other hand, it was contended that there was no breed of sheep, for grazing purposes, better suited to this district, particularly where early maturity is an object, than the first cross between the Southdown ewe and the Leicester tup, and as both breeds possessed great aptitude to fatten, (the Leicester in the greater degree), the stock obtained from such a cross could not be inferior to either parents. There were some sheep called half-bred Leicesters, but partaking of several crosses, whose fattening properties were greatly inferior to those of the first cross, neither is the mutton so good in quality. It was also argued that Downs require more time, and although it was allowed they possessed more hardihood than half-bred sheep, and can be kept to more advantage in greater quantities, still they would never produce so much weight of wool; and as sheep in this neighborhood are generally returned at from twelve to fifteen months old, and many are often sold in the wool, there were none so suited for these purposes as the latter breed. An animated discussion took place on this subject, occupying this and part of a subsequent evening, which ended in the adoption of the following resolution:—

Resolved—"That for the purposes of a breeding flock, the pure Southdown is the best; and that for grazing and where early maturity is an object, the first cross between the pure Southdown and pure Leicester is the most desirable, as possessing more aptitude to fatten, and producing greater weight of fleece; but where a large quantity are kept and a longer time allowed for fattening, there is no better description of sheep than the pure Southdown." * * *

[*From Isle of Thanet Farmers' Club.*]

A discussion took place respecting turnips, when the general opinion expressed was, "That manuring immediately before the seed is sown, will produce a better crop than dunging the land in the winter; and that drilling Swede turnip seed at ten furrows to the rod, and other turnips at twelve or thirteen furrows, is the preferable method."

The subject for discussion on the 5th of January was, "The best time for cropping the land." There were only seven members present, one of whom stated, "That to his knowledge some barley sown in January, was better when harvested than that sown in March, the same year." Another stated, "That he knew barley sown in February, better than that sown in April." The following resolution was unanimously agreed to:—

"That all spring corn shall be sown as early as possible, provided that the ground is in a proper state to receive it." * * *

At the meeting on the 9th of March, on the subject of "making manure," it was contended by some members, "That it is best to allow the animals that are fatting to go loose in the farm-yard." It was also contended, "That it is a good plan to keep a sufficient number of bullocks tied up fatting, and have others loose in the yard, ready to take the place of the fat ones as they go off." The following resolution was agreed to:—

"That it is the opinion of this Club, that to make the most and best manure in the yard, is to feed beasts with Swede turnips and oil cake, with cut hay and straw, about a quarter part of the latter, to exclude as much superfluous water as possible, allowing the animals to run loose."

FACTS ON FOOD AND MANURE.

From Squarey's Treatise on Agricultural Chemistry.

"It has been before stated that every part of a plant contains nitrogen as well as carbon; but, as an invariable rule, the seed of all plants contains a much larger quantity of nitrogen than the leaves and stalks, and a lesser quantity of carbon, and inversely, the leaves and stalks contain a much greater quantity of carbon, and a lesser quantity of nitrogen. Now when a horse is fed on grass, his food consists almost entirely of carbon; and the result is, that when he has a sufficient supply he gets fat—that is, that particles of oily, fatty matter are deposited on the muscles under the skin; but, as it is well known, a horse in this condition is quite unequal to any work, and the least exertion reduces his bulk. But when the same horse, under other circumstances, is fed on corn, his food consists principally of nitrogen; and although he may, never, under this keep, get as fat as under the other, still the increase he does acquire will be pure muscle, or, as it is technically called, sound flesh; and on this keep he can perform infinitely more work with less fatigue than on food containing no nitrogen.

"A more complete instance could not be ad-

duced to show that animals as well as plants can only assimilate that food which is presented them; in the first case, carbonaceous matters being the food of the horse, carbon is deposited in the shape of fat; in the latter, when more nitrogen enters into the composition of his food, the deposite of muscle preponderates. So it is with wheat. With a manure that only supplies carbonaceous matter, starch is the result. With a manure containing nitrogen, gluten is formed; both cases being completely analogous, and affording unerring proof of one simple and uniform law."

Another example of the singular effects resulting from the use of a chemical manure; not in the common and well known case, resulting from all manures, of an increase in the quantity of the crop, but in the quality. The authority is Professor Daubeny, of Oxford.

"In an analysis of one hundred parts of two different specimens of wheat which were grown on the same field, one of which had been dressed with the nitrate of soda and the other not, the result was—

Wheat on which nitrate was used, gave	
Bran	25
Gluten	23½
Starch	49½
Albumen	1¼
Extract, loss and water	1
	100
Wheat on which no nitrate was used, gave	
Bran	24
Gluten	19
Starch	55½
Albumen	1¾
Extract, loss and water	¾
	100"

Thus it is seen that the wheat so nitrated contains four and a half per cent. more gluten and one half per cent. more albumen than the wheat not nitrated; and as it has been stated that gluten is the substance to which flour owes its nutritious qualities, this alone would prove our position. But if we carry our investigation further, and see its results as to the real produce of bread, we shall be more fully convinced than ever of the utility of this manure. And here again we resort to experiments made by the same distinguished professor, for an elucidation of the fact.

"Three pounds and a half of flour made from wheat dressed with nitrates produced 4 lbs. 14 oz. of bread; whilst three and a half pounds of flour, made from wheat where no nitrate was used, yielded only 4 lbs. 4 oz. of bread; thus leaving 10 ounces of bread in favor of the wheat so nitrated."

THE FARM AND FARMING OF THE REV. J. H. TURNER.—NO. I.

To the Editor of the Farmers' Register.

In the last (February) number of the Farmers' Register, I am personally called on by my highly respected friend, Dr. Dupuy, for a general detail of my mode of farming. This call is also seconded by the worthy editor himself. Being thus publicly and respectfully called on, I do not feel at liberty to refuse. On the other hand, I promptly and cheerfully comply, and, in my turn, I call on the doctor, and hope that you and he will call on other successful farmers to imitate my example.

Indeed, I have long thought that this is one of the very best modes to diffuse practical agricultural information among the people. We now have several very valuable agricultural periodicals circulating in our country; and I have no doubt that the very best expedient for increasing their circulation and usefulness is, for practical farmers generally to do just what I am called on to do at this time. It is true, and I must in justice to myself state the fact, that I do feel a great reluctance in presenting myself in the prominent attitude which I must necessarily assume in such a communication. Were I to consult inclination alone, I would certainly still occupy the same quiet retirement I have hitherto enjoyed. But my friend, the doctor, intimates, very truly, that there is no free-masonry among farmers. If they have any thing that is valuable, whether it be animal, seed, implement, or information, they are very willing to share the benefits of it with their fellow farmers. The only difficulty is to bring them to the pen. They will *talk* by the hour, or even the day, but to *write* is a labor from which they insist to be excused. I, in common with them, have this same feeling; and with me it is so strong, that it requires no little effort to shake it off. But I will try, and if I can be of any service to this good cause, and especially if I can call out the doctor and other judicious farmers in the same way, I shall feel that I have accomplished a great and good work.

With these remarks, I shall at once proceed to the thing in hand. And here I will not, through false modesty, disguise the fact that I have been successful in farming. This success, under GOD, I mainly ascribe to two things. The first is, that from the beginning, I endeavored carefully to avoid the faults, or mistakes, if you please, into which I clearly saw that many others had fallen. And the second is, that I was careful to avail myself of all the local advantages which my peculiar situation afforded.

Under the first head I will mention, as a palpable fault, I may even call it the crying and ruinous sin of farming, the great, the excessive quantities of land that many are anxious to encumber themselves with. I call all that land *excessive*, and even worse than useless, which the owner cannot turn to a profitable account. When, therefore, a man has as much land as he can cultivate well, furnishing as many shifts as an improving mode of farming requires, and besides this, as much in woods as will supply materials for his enclosures and fuel, all besides is a mere expense without any profit. I could now, did it not seem invidious, point to many splendid estates, which, so far from paying a fair profit, do not yield two per cent. on the original cost and fixtures; nay, some, I verily believe, bring the proprietors in debt every year. And what can be the reason of this? It is not because there is not space enough to operate on, it is not because the lands are so poor as to be absolutely unproductive, nor is it because there is not sufficient force to cultivate them; but it is simply because there is more capital involved than can be turned to a profitable account. I mean that the land, the labor, the stock, and the neces-

sary fixtures have altogether amounted to a sum on which the products can pay nothing. This, therefore, must necessarily be a losing concern.

Besides, these overgrown estates require every thing on a corresponding scale. The house, the stables, the garden, the pleasure grounds, the dinings must all be large. But these large things cannot be called into existence for nothing; nor can they be continued for nothing. Large establishments always demand large expenditures. Whilst therefore the income is large, the outgo is still larger. And hence it is that these great estates have often changed hands in less than three generations.

Another great error into which many farmers fall is, that they undertake more than they can accomplish. They plant more than they can cultivate. The consequence is, that the ground being badly prepared, and the culture defective, the crop must necessarily be a poor one. I have no doubt that the same manure and less than half the labor, expended on a few acres, would often produce more than the whole farm, cultivated as it now is.

Connected with this I will mention, that many farmers keep more servants and more stock than they can employ in a profitable way. The master must have his body servant to brush his coat, and his groom to saddle his horse; and the mistress must have her maid to do up her caps, and her house-keeper to carry her keys; and then, jointly, they must have their carriage-driver, and footman, and butler, and dining-room servant, and nurse for every child, and laundresses, and meat-cooks, and pastry cooks, and scullions, and head gardener, and under gardener, and I know not how many domestics besides, and all these with one or more apprentices under them. Then there must be the saddle horses, and carriage horses, and the bob-tail ponies for young master and young mistress to ride. Now all this looks very well on paper; but the question is, who can support it? Or if things do not proceed to the extreme stated above, it is a well-known fact, that farmers do generally keep more servants, and more horses, and more dogs, and other mere matters of pleasure, than they have any use for.

Now I had observed these and other kindred faults, and, when I became a farmer, I determined to avoid them; and reared as I was to habits of labor and economy, I found no great difficulty in doing so. My first purchase was therefore a very small one. I bought just so much land as I thought, with my means, I could bring speedily into profitable cultivation. The capital so far invested was a small one; nor did it require any great outlay in ditching, inclosing, manuring, labor, and every thing else necessary to use. I however made a great many mistakes, which subsequent experience enabled me to correct. One I will mention. In preparing for my little corn crop, I applied my manure in the drill, and not broadcast. This will do where the crop is corn, and corn alone, but will not do when it is to be followed by subsequent crops. I saw my mistake, and never afterwards repeated it. This plan of spreading a little manure or a little labor over a large surface cannot be too strongly reprehended. It is mere waste; whereas, if it be confined to proper limits, we at once derive the benefits of it.

I ought to mention, that at the time alluded to above, I was engaged in other business in town. This I regarded as my main pursuit, whilst the farm was resorted to for amusement. I had fancied to myself, that after spending a sultry day in town, it would be very pleasant to resort to my country establishment in the afternoon, and there regale my senses with the beautiful fields and fragrant flowers. But I soon found that a farm, even a *small* one, will not suffer itself to be treated as a *plaything*. Do what you will, it will maintain its solid importance—*it will fill your pocket or empty it.*

I must also mention, that the interest which I took in my farm was of a constantly increasing character. In fact, it soon took such a strong hold upon my thoughts and affections, that I was rendered unfit for any other pursuit. The other business, therefore, in which I was engaged, became intolerably irksome. I began it late, and I despatched it as rapidly as possible. I was now engaged in two pursuits, the one was a mere drudgery, the other was my delight. It will create no surprise then when I state, that I soon shook off my town employment, and gave myself wholly to the delights of the farm. Instead of short mornings and afternoons, I now spent whole days in my darling pursuits.

But it would be tedious to detail the various sources of new enjoyment which now presented themselves to me. If I planted a seed, I wished to witness its earliest vegetation; and if I set out a shrub or plant, I wished to inhale the first fragrance of the opening flower. I even thought the shade of my own tree, or the draught of water from my own well, more cooling and refreshing than any other. And I am sure that I never enjoyed the exquisite relish of fruit in all its perfection, until I plucked it from the tree of my own planting.

But before I quit the subject of these pleasure farms, I think it proper to say a little more about them. The impression, I know, is very general among the good citizens of our towns, that such establishments may be resorted to as places of mere pleasure. They figure to themselves a pretty white cottage, with green window shutters, in the very midst of neatness and beauty itself. Here are shrubs, and flowers, and odoriferous plants; and here every thing is beautiful and sweet and fragrant. Then this earthly paradise is so located, that a ride or walk of an hour will carry the fortunate proprietor to his business in town. Oh! how delightful to place wife and children in this beautiful spot during the sultry months of summer? I admit that in one event, and one only, it would be so, and that is where a large property has already been acquired, or where the present business is so lucrative as to sustain the expense. Without this, such a place is a mere moth; it is a constant and rapid drain upon the former or present earnings. It is then the very last thing in which the man of moderate circumstances ought to think of indulging. In fact, I know no instance in which this *double* business has succeeded. One establishment is invariably a drain upon the other.

But whilst I say this, my experience warrants me in adding, that the man of industrious and persevering habits, may so succeed on his small farm, as to justify him in giving up his town business. Accordingly, when I was drawn to the

country, I made farming my only pursuit. In the course of a few years, I cleared the whole of my first purchase, and so enriched it as to make its cultivation profitable. I then bought more land; and as more labor became necessary I added it also, but always in small quantities at any one time, making it my invariable rule to improve as I proceeded. Thus I continued until, before I was aware, I fell into the common error of farmers: I *got too much land*. A considerable portion of my farm may now be fairly called a garden spot. Just that much I consider profitable, and just that much I ought to own, and no more. The residue, which is too poor or too wet to bring a profitable crop, is a mere incumbrance to my little estate, and I should be better off without it.

Having now detailed certain great evils which I endeavored to avoid—all of which may be summed up in one word—*excess of capital*—I will now advert to certain other things which I thought it of equal importance to *practise*. In this view I would present, as claiming the very first rank, what I would call a system of judicious economy. And here I wish it to be distinctly understood, that by this term I do not mean a niggardly spirit, nor a stinting in any form whatever. I mean that, whilst every body and every thing has a sufficiency, there be nothing wasted. This system I have earnestly endeavored to establish on my farm. In this, I have had to row against wind and tide. There seems to be in the negro an innate propensity to profusion; we see it displayed in his food, in his clothes, and even in the comforts which are exclusively his own, and in all the departments which come under his direction. This propensity, I believe, can never be effectually counteracted; but the injury resulting from it may be in some measure obviated, by the constant vigilance of the master.

But the economy which is ordinarily most profitable on a farm, consists not in mere saving, but in lopping off all useless expenditures. It is in vain to save at one point, whilst a greater loss is sustained at another. I have long been convinced that it is only the speculator or gambler who can make or lose a fortune at a dash. The farmer's wealth never comes to him borne in on the torrent. It is always wafted on the small and gentle rill; and he is the best manager who conducts a great many of these little rills into one general reservoir. The whole machine should therefore be so constructed, and kept in such order, that all the parts may work together. Whilst industry is employed in creating, economy should be equally busy in taking care. In accordance with this, I make it a rule in my little establishment to dispense with every thing that does not in some way or other contribute to our immediate comfort or profit. Every servant and every horse has full employment. I keep no breeding woman nor brood mare. If I want a negro, I buy him already raised to my hand, and if I want a horse or mule I buy him also. Now I will readily admit that it will not do for every body to practise on this Shaker principle; but in my peculiar situation, (of which more hereafter,) I think it cheaper to buy than to raise. At my house, therefore, there are no noisy groups of mischievous young negroes to feed; nor are there any flocks of young horses to maintain.

There is another propensity among our negroes, always annoying, and sometimes attended with considerable loss to the master, and that is a disposition to pilfer. Perhaps there is no farmer, especially among those living near our towns, but is put to more or less inconvenience on this score. In common with others, I have suffered considerably from it, particularly in the loss of my pigs and shoats. It so happened, that if I took a special fancy for any pig, some rogue took an equal fancy for the same; and, somehow or other, he contrived to strengthen his fancy by "the nine points of the law." His fancy thus became stronger than mine, and I was obliged to yield. This inconvenience I resolved to remedy, but the difficulty was to set about it in the right way. After much reflection, I became convinced that my own negroes were the rogues, or that they connived at it in others. The thing could not happen so often without their knowledge or concurrence. Whether, therefore, principals or accessaries, my own negroes were guilty, and the remedy was directed to them. With a view to this, I resolved to take from them all apology for stealing, as far as *necessity* was concerned. I regularly gave to them an ample sufficiency of substantial food—bread without stint, and meat, besides fish, to the amount of four pounds per week. And here let me indulge a passing remark, that of all the hogs I have ever seen, none is to compare to the Berkshire; for besides a fine, round, juicy ham for the master, it furnishes a large fat middling for the negro. And this is precisely the kind of meat which is suited to him. But to return to my expedient. My negroes were also made comfortable as to their clothing and lodging. In addition to these things, which I had reason to believe they would regard as their *rights*, I resolved to allow them other indulgences, which they could but consider as *privileges*. Accordingly, every one is allowed a small piece of good land, which he cultivates as his own. The crop which grows here is the negro's crop, and I exercise no control over it whatever. When the land is broken up for my crop, the negro is allowed time to break up his also; and when my crop is planted or cultivated, his is also; and when mine is gathered, he gathers his, and measures it in my presence, and I commonly become the purchaser. Some persons, I am aware, object to the patching system, alleging that it furnishes facilities for stealing; but managed as above, I cannot think it fairly subject to that objection. On the other hand, good consequences, as I think, result from it. It makes my negro satisfied, and it gives him an interest in his *home* which he cannot otherwise have.

But, besides his patch, I allow to each laboring hand a barrel of corn, or its equivalent in money, and the time of settlement is his great holiday, Christmas. At this time, above all others, our negroes are anxious to have some spending money. Now, by means of this boon, so highly prized by them, I believe that I have succeeded in keeping my negroes perfectly honest for the last four or five years. The practical working of the thing is in this way: if a depredation is committed, *no matter by whom*, my negroes are responsible for it, and double its value is deducted from the Christmas present; or if a tool has been lost, its value is deducted in the same manner. If, however, the thief is given up, and all have an

interest in his detection, the whole responsibility rests on him, and the others are of course exonerated. By this means I also secure my property from the depredations of the neighboring negroes. Thus, a few barrels of corn are made the means of saving my property to perhaps ten times the amount, the whole year; and I am also spared the painful necessity of frequent chastisements. This plan has thus far succeeded so much to my satisfaction, that I determined to state it publicly; and I am very much inclined to the opinion, that were it made general, it would go a great way towards breaking up the whole system of thieving among our servants.

But I have written enough, and perhaps too much, for one paper. From the above it will be seen that, as a foundation for my farming operations, I have endeavored to avoid excessive and injurious outlays in land, negroes, stock, and the other necessary fixtures. The whole may be summed up in this short sentence: The capital involved is as small, as compact, and as available as I could make it. If in the detail I have given to myself a prominency which a becoming modesty would forbid, my plea is, that I have stated the truth, and I could not in candor state less. If this apology is not sufficient, I rely on you, Mr. Editor, and on my good friend, Dr. Dupuy, to supply the deficiency. In my next (for having commenced, I know not when I shall quit,) I propose detailing my plan for enriching my farm.

J. H. Turner.

ORIGIN OF PAPER MONEY.

From Gouge's Journal of Banking.

It is a fact well worthy of notice, that in all countries into which paper money has been introduced, it has owed its origin, not to the demands of commerce, but to the necessities of the state. The reason for this is, that commerce creates its own medium. In commerce, conducted on legitimate principles, mere *promises to pay* are never substituted for actual payment. The merchant may buy much on trust, but when the day arrives on which he has promised to pay, he will, if solvent and honest, fulfil his engagements.

The necessities of the state, in very ancient times, introduced paper money into China, into Tartary, into India, and into Persia. And in modern, or comparatively modern times, the necessities of the state have introduced paper money into Italy, Spain, Portugal, France, Germany, Russia, Sweden, Denmark, Great Britain, the United States, Brazil, and Buenos Ayres.

There are some who suppose, or seem to suppose, that without paper money there would be little or no commerce. We would call their attention to the fact, that in no one country did the necessities of commerce give rise to the use of paper money. The fact is of importance.

The Bank of England was established on condition of lending *all* its capital to government. The first issue of paper money in this country was made by Massachusetts in 1690, not to serve the purposes of commerce, but to satisfy the demands of some clamorous soldiers. The next was made by South Carolina in 1712, to defray the expenses of an expedition against the Tuscaroras. The first of our regularly constituted paper money banks was the Bank of North America. Private scheming was undoubtedly at the bottom of this, but the schemers owed their success entirely to the hopes they held out of relieving by their new institution the pecuniary wants of government. The like is true of the first Bank of the United States.

Banks have, indeed, been established in different countries, solely to aid the operations of commerce. Of this kind were the banks of Hamburg and Amsterdam. But they were *hard money* banks.

PAPER MONEY REFORM.

From the same.

In no country into which paper money has been introduced has the system been reformed. In all, the enormity has gone on increasing, till it has exploded. It was thus with the paper money of China, thus with that issued by Law in France, thus with the assignats, thus with our provincial paper money, thus with our continental money. And thus, we suppose, it must be with the present paper money systems of Great Britain and the United States.

In Austria, France, Portugal, Sweden, Denmark, and perhaps in other countries, as well as Great Britain and the United States, instances have occurred of banks suspending specie payments and afterwards resuming them. But this is, at best, but a partial reform. Banks in which the copartners are exempted from personal responsibility, are chartered monopolies of the most odious description. And whether such banks pay, or refuse to pay, specie on demand, their paper never can adequately perform the *chief* function of money. It may be very convenient as a *commercial medium;* but as a *measure of value* it is one of the most *deceptive* that can possibly be imagined.

ACCIDENTAL EXPERIMENT. RESULTS OF TOP-DRESSING ON CLOVER.

Extract from the Farmers' Cabinet.

On walking over a clover field which had then been mown the second time for seed, and the crop raked into wind-rows, I observed that a square space, about an acre, was much more thickly set, and the leaves of a more vigorous appearance than any other portion of the field, and seeing that the great thickness of the crop was marked with the exactitude of a line, I pointed it out to my friend from a distance, as the work of a bad mower, who had left a part of the crop on the land, not having cut "the bottom half inch;" but on a closer inspection I could perceive that the line ran *across* the swathes, and not *with* them; so that this could not be the cause of the very great difference in the appearance of the crop, which was found to proceed altogether from a closer plant of much more vigorous growth; on which my friend remarked—"The clover-seed with which this field was sown was saved by myself, was carefully cleaned in the barn, and taken

immediately from thence and sown in the field; but my seeds-man scattered it too plentifully at first, and the consequence was, the clean seed was all exhausted and the square which you see was left unsown; but not being willing to leave this portion of the field without a crop, and having no seed at hand, I took the clover-chaff from the barn and scattered it very thickly over the unsown portion of land, thinking there might be a few seeds contained amongst it; and you now see the result, after two crops of far heavier bulk have been removed from the spot before us."

THE POTATO.

From the same.

Mr. Editor—It is perhaps not generally known to the subscribers of the Farmers' Cabinet, that in the potato there are two parts, which, if separated and planted at the same time, one will produce tubers fit for the table eight or ten days earlier than the other. This fact has fallen under my own observation, and is the plan I now pursue in order to obtain an early supply for my table, fine and very mealy. The apex or small end of the potato, which is generally full of eyes, is that part which produces the earliest—the middle or body of the potato produces later, and always large ones. The butt or navel end is worthless, except for feeding stock, and if planted produces very indifferent small ones, and often none at all, the eyes, if any, being imperfectly formed. The potato being cut two weeks before planted, and spread on a floor, that the wounds may heal, separating the small end from the middle, then cutting off the navel or butt, the body or middle of the potato is then divided into two pieces lengthwise, taking care to have always the largest and finest selected, being convinced that if none but large potatoes are planted, large ones will be again produced; small things produce small things again, and therefore no small potatoes should be planted; this practice is too prevalent, and may account for the many varieties and small potatoes met with in our markets. Who would not prefer a large mealy potato to a small one, that will take hours to boil soft, and then may only be fit to feed the cattle with?

For several years past I have adopted the plan of putting potatoes into the ground late in the fall, covering them with manure, sometimes with tanners' waste bark, and always have succeeded in raising a fine early crop. Last fall I had taken up some as fine and large Mercer potatoes as any one could wish; they were covered with tan six inches thick the preceding fall; many weighed sixteen ounces. No particular care or attention was bestowed upon them through the summer, the tan not permitting any weeds to trouble them, or to draw out the nourishment from the earth, they had therefore all the benefit of the soil, kept moist and clean by the tan, for tan will keep the ground moist and clean, and in an improved state, in the driest season. I have found the great advantage of it to my asparagus and strawberry beds, which are annually covered with it.

The potato I consider so valuable and indispensable a vegetable, and having never seen a suggestion in print of separating the potato and planting each by itself,* that I have been induced to send you this imperfect and hastily drawn up communication. Perhaps you may think it worthy a place in the Farmers' Cabinet, and if so, should be pleased to hear that some of its patrons will try the experiment of planting separately each part of the tuber, believing that the potato may be much improved by a due regard to the above suggestions. J. F. H.

Lancaster, February 26, 1842.

MAGNESIAN LIME.

From the same.

At page 276 of vol. v. of the Farmers' Cabinet, in a short extract from the "General Report of Scotland," it is stated that "it had been long known to farmers in the neighborhood of Doncaster, England, that lime made from a certain stone, and applied to land, often injured the crops considerably. Mr. Tenant, in making a set of experiments upon this peculiar calcareous substance, found that it contained magnesia, and on mixing some calcined magnesia with soil, in which he sowed different seeds, he found that they either died or vegetated in a very imperfect manner, and the plants were never healthy; and with great justice and ingenuity he referred the bad effects of this peculiar limestone to the magnesian earth it contained. Yet it is advantageously employed in small quantities, seldom more than 25 or 30 bushels per acre."

Mr. Tenant's account of his experiments first appeared, we believe, in the Philosophical Transactions of England, and we know not that it ever appeared in any other form. It is certainly not in very general circulation. We cannot say, therefore, how extensive, varied and accurate the experiments may have been. But it is from such vague, loose and indefinite accounts as the above, that we are called upon to swallow the whole doctrine and all its consequences—head, horns and all, without making a wry face, and that too in opposition to a host of proofs of its utter fallacy, derived from one of the most extensive and decisive experiments ever made in agriculture.

But leaving Mr. Tenant's account of the matter out of view for the present, let us examine that which the advocates of the doctrine it was intended to support have vouchsafed to give us. They tell us that he mixed *some* calcined magnesia with the soil, (but they do not tell us how much,) and found that seeds sown in it either did not come up at all, or if they did, did not grow vigorously. Well, we grant that they did not. What then? Does it necessarily follow that magnesia is destructive to vegetation? Suppose he had mixed pure lime, or even pounded chalk, with his earth, every body knows, or may easily ascertain, that if an undue proportion of either were used, his plants would have withered and died, the same as they did in the magnesian mixture. Would it not then be just as philosophical to assert that lime was in the latter case injurious to vegetation, as that magnesia was in the former?

Here then appears but a single unvaried expe-

* At p. 132 of the Cabinet, vol. v. our correspondent will find this subject particularly treated.—Ed. Cab.

riment, with an attempt to build a very important theory on the narrowest possible foundation of fact. And never has a hastily formed or unsound theory been more signally overthrown by subsequent experience. Instead, therefore, of saying that it was just and ingenuous to refer the injurious effects of the lime in question to magnesia, we should rather say that it was a hasty and unjust conclusion, and would never have been put forth by one acting under correct views of the requirements of the inductive philosophy.

But it is not against the possibility of the injurious nature of the Doncaster limestone, or of the correctness of Mr. Tenant's experiments, for we care not a straw whether they are correct or otherwise; but it is against the broad doctrine of the deleterious nature of magnesian lime in all its forms, attempted to be deduced from them, that we contend. It is against the senseless repetition of this doctrine, unsupported as it is by any subsequent experiments, by every unfledged agricultural essayist, or every enthusiastic builder of plausible theories, that we enter our protest. Agricultural publications are extending in circulation every day, and are beginning to be looked up to as sources of correct information. It is of importance, therefore, that theories diametrically opposed to every day's experience should not be reiterated in them again and again, without attempts being made to show their utter fallacy. Lime, in some parts of our country, is a very costly article for manure, owing to the expense of carriage. A young farmer in one of these has a poor exhausted farm. He sees in the Cabinet and other publications lime highly recommended as a manure, but he also sees essays professedly written by practical men, wherein it is repeatedly set forth that all magnesian lime is deleterious to vegetation, and that each one whose liming has not answered his expectation, refers his disappointment to this cause. He takes up the reports of the different geological surveys lately made in this country, and learns from them, as well as the pages of the Cabinet, that a very large proportion of the limestones of our country are magnesian, and many of them highly so. Would not such a person probably reason thus:—I am very poor as well as my land. This lime is a very expensive thing. I shall probably get of this bad kind, as I am no judge of the article. I shall lay out my last dollar, and probably make my land even worse than it now is. Would he be likely to lime under such views? Would he not more probably toil on from year to year as poor as he began—still afraid to apply the great renovator to his soil? To such, however, we would repeat, what we have already said, that all the benefit which has been derived from lime as a manure, to Pennsylvania and to a great part of New Jersey and Delaware, has been derived from magnesian lime. This is fact and experience; the other is but theory based on a narrow foundation. Then let not this bug-bear of magnesian lime, set up by those who seem to be profoundly ignorant of what is passing around them, deter you from following the bright example set you by the enlightened farmers of south-eastern Pennsylvania. Put on your magnesian lime in such quantities as their experience may have pointed out. Shut your ears against this senseless clamor, and after you have faithfully done your part, trust the rest to the silent, unseen, mysterious operation of those laws which govern the material world, with the full assurance that you will reap a rich reward. S. Lewis.

Dec. 28, 1841.

MAGNESIAN LIME.

From the same.

Mr. Editor,—On reperusing the pages of the back numbers of the Cabinet, a custom to which I confess I am much addicted, I find an article at page 339 of the 5th volume, on "Magnesian lime," which I would wish to notice, for the purpose of drawing from the writer farther information on a topic which still agitates the minds of some of our practical friends, although to him this must appear strange after what he has said to settle the question by a verdict which would seem to admit of no appeal: but as facts are stubborn things, and eye-testimony goes a good way with a class of persons who are accustomed to judge pretty much by the light afforded by that mode of reasoning, I have wrought myself up to the point of encountering from your correspondent a withering glance that may possibly render me incapable from ever looking into the subject again; and yet that would be a pity, for how could such as I come to a knowledge of the truth, if we were to give up one of our seven senses, and consent to be led by the doctors, *seeing*, as we do, that none are more apt to differ than they?

That the presence of magnesia in lime was once believed to be injurious to vegetation, cannot be denied. That it is now by many considered rather advantageous than otherwise that it should contain a certain portion of magnesia, would also appear to be a fact; while others there are who look upon its presence as neither beneficial or hurtful, farther than robbing the lime of just so much *carbonate*—to which state it returns on exposure to the atmosphere—as it is found to contain on analysis. Now which way lies the truth? And after Mr. Kinser has answered this question, I would ask why is it that lime, when quite pure from magnesia, can be applied in almost any quantity to land in almost any state, whether of poverty or fertility, without injury to the crop, while that which contains magnesia, to the amount of about 40 per cent., cannot be used on the same soils and under the same circumstances to a greater extent than, say from 40 to 60 bushels per acre without manifest injury? We are told that in England lime is given with impunity, even to the amount of 500 bushels per acre—what would be the result if such excess were indulged in here with lime containing 40 per cent. of magnesia? It may be said the difference is in the climates of the two countries, but I must be permitted a difference of opinion. In the third volume of the Cabinet, pp. 14, 17, there is recorded a series of experiments, the correctness of which I was informed by the then editor of the Cabinet might be implicitly relied upon, as they had been copied from a diary or journal that had been kept by the writer while in the management of certain estates in Wales, upon which they had been most carefully conducted, for the purpose of ascertaining the value of lime in agriculture,

and where occasions had offered to prove that its application, even to the extent of more than 500 bushels per acre, had been attended with the most beneficial results ; but there the limestone—a pure black marble—contained, by analysis, 98 per cent. of carbonate, with not a trace of magnesia. If the readers of the Cabinet, having the 3d volume, would turn to these pages, I think they would be much interested with a perusal of their contents.

At page 275 of the 4th volume of the Cabinet is a letter on this subject from Mr. Mahlon Kirkbride, of Morrisville, Bucks Co., which shows conclusively—at least to me, who saw and examined the land upon which the lime had been used in the way that he states, and found it comparatively barren, the year after the time when he wrote—that the injury had been caused by the lime, which, it is admitted, contained magnesia in its composition. He says, "my father had a field of 25 acres of as good wheat soil as could be found—a deep loam. Its produce for years stood almost unrivalled ; he, wishing to make it still better, applied to a part 50 bushels of lime to the acre, to the balance (excepting half an acre) about 65 or 70 bushels to the acre ; the result was as follows : in 1837, wheat crop not much more than the seed ; 1838, corn, about 10 bushels per acre on the heaviest limed parts, on the other 40 bushels ; 1839, oats good where there was the least lime, on the other part 15 to 20 bushels per acre. The half-acre above alluded to received 50 bushels, and the result was, of wheat not a handful ; of corn, some stalks three feet high and two bushels of nubbins ; of oats a growth of straw 16 inches high, which refused to show any symptoms of ripening, and was cut to get it out of the way." It must be added, the spot on which the lime had been deposited when taken from the canal-boat, and from whence it had all been removed with the most scrupulous care, had not, three years after, produced a single trace of herbage, not even a weed—would Mr. Kirkbride be pleased to inform us of the *present* state of that portion of his land ? At page 55 of the 5th volume of the Cabinet, notice is taken of Mr. Kirkbride's communication by a writer who has had great experience in the use of lime, and it is to be regretted that he did not give us the analysis of that which he applied so unsparingly and profitably.

Now I am sure I have no private interests to serve, and no prejudices to support, but I would just ask Mr. Kinser, at the risk of having applied to me the old adage, "a fool can ask more questions in an hour than a wise man could answer in a month," 1st, How is it that when the lime from Messrs. Potts and Dager's quarry, containing 96 per cent. of carbonate, and not a particle of magnesia, is exposed in a heap, and has become perfectly slaked, that white-clover and the finest grasses will be found to penetrate through the lime at the margin of the heap from the depth of perhaps an inch or two, and spread over its surface ; and on the removal of the heap, that the herbage will grow on the bald spot and become a rich turf in a short time ? 2d, How is it, that the lime burnt from the stone quarried from the south side of the valley at Downingstown shows exactly the same results ; while that produced from the stone quarried from the north side of the same valley, perhaps not a quarter of a mile distant, is totally different in its effects, destroying all vegetation, and leaving a galled spot for years where it had been deposited for slaking ? for this fact, and a true analysis of these two varieties of limestone, I would appeal to Dr. Sharpless and his brother, who reside on the spot, as also to Mr. Lindley in the immediate neighborhood, asking of the latter gentleman if he has not known oats, sown on a limed soil, to penetrate through a lump of lime several inches in thickness, and grow to the height of about five feet with the greatest luxuriance, *that* lime having been procured from the south side of the valley. The difference between the two stones being peculiar likewise, that from the north side being *heaviest*, but producing the lightest lime—the stone from the south side being lighter, but producing the largest quantity of pure lime ; showing that more foreign matter had been thrown off and dissipated during the process of calcination from the stone obtained from the north side of the valley, and proving conclusively, the greater purity of that from the south side. And 3d, I would ask, was it ever known, that herbage would spring up on the margin of a slaked heap of lime containing 40 per cent. of magnesia, even penetrating through it from the depth of an inch or two, and spreading over it, and for the earth to show no sign of its pernicious effects in the shape of a galled spot, after its removal ?

The subject is of vast importance, and is the cause of my troubling you with this communication, my object being to "keep the ball in motion," and to elicit the truth. And to this end, I would take the liberty to ask your subscribers, Mr. R. T. Potts, Mr. Dager, and their neighbor, Mr. Henderson, who has, I understand, erected a kiln for the purpose of calcining the cuttings of his pure white marble, whether they have it not in their power to throw some light upon the matter, not doubting that the white marble of Mr. H. contains at least as great a proportion of carbonate of lime as the beautifully mottled variety of Potts and Dager, namely, 96 per cent.

That magnesian lime has proved of very great service when applied to the soil, no one can deny, for the evidence is before our eyes ; but I hope that the subject may be investigated to its better understanding, without fear for the result. And I know of no one who has it in his power to do us more service than your correspondent—will he, therefore, take the above remarks into his consideration, and favor us with his conclusions ? I am, I must confess, by no means inclined to *blink* the question, lest it should "arrest the march of improvement, and throw cold water on the spirit for liming" which is abroad in the land, but I do wish that your correspondent would inform us of the cause of the very great difference which is seen in the effects between lime containing 96 per cent. of carbonate and no magnesia, and that containing about 50 per cent. of carbonate and 40 per cent. of magnesia. It may be that magnesia operates in a different manner from lime—nay, it might perhaps be found to be more valuable than it for the purposes of agriculture—and to this I have not the slightest objection ; that is of no consequence, and need not frighten any one whose sole object is to become acquainted with the true mode of its operation.

P. S.—Since writing the above, the No. of the Cabinet for February has reached me, and I find that your correspondent, Mr. Lewis, of Pottsville, has embraced the opinion that the presence of magnesia in lime is not injurious for agricultural purposes, nay, that it is "diametrically opposed to it;" and to this decision he has been brought, not by a "two-penny experiment made in a garden-pot, or the corner of a field," but by its extended use over hundreds of thousands of acres through a long period of years, in opposition to the "would-be oracles of the day," or the theory that has been "babbled," on the subject. Now, by such men as your correspondents, Messrs. Kinser and Lewis, I presume we shall be sure that the subject will be properly treated, and the truth elucidated, but I would meekly ask why do these gentlemen use such strong language to express themselves, if they are not in some way interested in the matter? Surely it does not require such terms of contempt and reproach to silence the workers in a garden-pot or the corner of a field, or these very small oracles or babblers who presume to arise in their path? S.

Luzerne county, February 28, 1842.

REMARKS ON THE OPPOSITE OPINIONS OF MAGNESIAN LIME.

In the Farmers' Cabinet there has been recently revived, and is warmly contested, the old controversy as to the alleged deleterious action of magnesia in lime. Two of the articles are inserted above, which set forth the opposing views. This still doubtful question is one of the many subjects of opprobrium to agricultural science—or rather of chemical science pretended to be applied to agriculture. Chemical writers have been content to repeat, and *merely* theoretical farmers to believe, the opinion of Tenant, announced half a century ago; which opinion, however interesting and important to agriculture, and however true might be the particular experiment on which it rested, was certainly not established generally and fully. Other and varied experiments ought to have been made, both by chemists, and by practical farmers who had it in their power to try and compare the effects of lime from both pure and magnesian limestones. But while the various printed articles of argument, or loose discussion, would have filled a volume, there has not been carried through a single series of judiciously planned and accurately conducted experiments, which, if performed, would have decided all doubts, and removed every obstacle to this all-important branch of improvement in a very large agricultural region.

The fact that magnesian lime in large quantities is injurious or even destructive to vegetation and to productiveness of soil, however certain, is by no means a proof that the application of magnesia (either in its calcined and pure state, or when carbonated and mild,) is hurtful. There are other manures (indeed most others) highly beneficial in proper quantities, which are injurious in excessive quantities. Pure lime itself is adduced by the witnesses on one side to show that it may be applied in any quantity without damage to vegetation, and that benefit is found by increasing the dose to 500 or even 1000 bushels, in the caustic state, at one application. Yet, without undertaking to deny these particular facts, (as we know nothing of the precise conditions of the trials,) it is certain that our liming farmers in lower Virginia find 150 bushels dangerous, and 100 bushels or even less often unsafe. Yet no farmers in our region have made more profitable improvements, except the marlers, than those who have used lime. The kind most generally used by them, and from which all their facts of injury by excess have been derived, is oyster-shell lime, which is pure lime, containing no magnesia or other foreign matter.

Of shell marl, or merely calcareous marl, the principal and almost sole fertilizing ingredient is mild lime or *carbonate* of lime; and when we first commenced its use, we had no idea that any quantity of it could injure land by its excess. Yet a few years' experience showed great injury from applications containing not more than 200 and sometimes less than 150 bushels of the proportion of this mild lime. The richer the marl of course the greater the injury from a heavy dressing. Yet what farmer of common sense would therefore denounce the use of marl as injurious, or would prefer the poor to the rich, because 500 bushels of the poor produced great and continued increased product, while 500 of the rich would produce disease and great injury to the grain crops, for many years?

Theorists have extended the sound objections to caustic magnesia being applied too heavily as manure in newly burnt lime, to the existence of carbonate of magnesia naturally in soils, or in manures; and have inferred that, even in this mild or natural form, it was the cause of sterility. We have no practical knowledge of magnesian soils; but cannot believe that a substance so similar to lime in its chemical qualities can be so different in its operation as manure. Soils may indeed be barren from an excess of magnesia in their natural composition (if there be any such) as others certainly are because of excess of lime; and others by excess of the siliceous and others of the clayey ingredient. But any quantity of magnesia that could possibly be applied as manure,

after it had become carbonated and mild, we cannot believe to be otherwise than an aid to fertility. The bottom lands of the Red river, in Louisiana, have two or three per cent. of carbonate of magnesia, (according to the analysis of a specimen which we examined,) and other celebrated fertile soils also have this earth as an ingredient.

ED. F. R.

SUGAR BEET.

From the Farmers' Cabinet.

Mr. Editor—I find that the Massachusetts Agricultural Society has awarded a premium of $15 to F. Tudor, of Nahant, for a crop of sugar beets measuring 1300 bushels per acre. Mr. Tudor's account of the *management* of the crop—a statement which should, I think, always be made to accompany a premium crop—was as follows. "The ground was old pasture of indifferent soil and very stony; it was broken up in 1840 by trenching, 20 inches deep, which brought much poor soil to the surface. The stones were gathered from the land and buried in the bottom of the trench, upon which was spread three inches deep of mussel-mud, then the turf and the best of the soil, then two inches of rock-weed fresh from the shore, or cut from the rocks; then the less rich part of the soil and more mussel-mud, the top being left with the poorest and most gravelly soil. In the spring of 1840 it was sown with sugar-beet, but the crop was poor. In 1841 the land was ploughed six inches deep without reaching any of the rich soil below, the surface still exhibiting little but yellow loam and gravel. Upon this I caused sugar-beets again to be sown, and when the plants had sprung up, I had the land *dressed on the surface*—merely spreading on 15 cords of rich cow-yard manure. This caused the young plants to shoot and grow away most vigorously, and the crop has been so large that I have determined to exhibit it before the State Agricultural Society, and put in a claim for premium. No particular care has been taken of the crop, for although the seed had missed on several patches, they were not filled with plants, while during the drought of August, many of the tops were cut as fodder for cows; but for this, I believe the crop would have produced 1600 bushels per acre. The crop was sold by auction, and the weight given was what the purchasers paid for. The largest root measured 34 inches in circumference, and weighed 31 pounds, but it was hollow; the largest sound and perfect root weighed 21 pounds; a fair bushel weighing 60 pounds. I think the large crop which has been produced on my land was not caused by the trenching, but *by the looseness of the soil and the top-dressing of rich manure;* the value of a top-dressing in a season of drought being undoubtedly great."

I conclude with one remark—the above account speaks volumes for the system of subsoiling and top-dressing, a mode of management which seems at length to be commanding the notice of agriculturists generally throughout the land.

J. GRANT.

MINUTES OF AGRICULTURAL FACTS.

1. *Green sand and gypsum of James river.*—In the beginning of March we saw for the first time the spot dressed with this manure at Evergreen, which was described at page 645 of vol. ix., and incidentally referred to at page 494, vol. viii. The superiority of fertility of the manured space, as shown both by the remaining stubble of the wheat crop of last year and the young clover, is very manifest, and is fully 50 per cent. over the adjoining ground, though that is very good and productive soil—a fine loam of medium texture, originally rich, and neutral soil, and marled previous to this application, which was made 8 or 10 years ago.

This is a most interesting subject for experiment, and this result is highly encouraging for further experiment and general use by the proprietor. But still there is almost every thing wanting to make this an *accurate* experiment of the effects, and the durability of green-sand *alone* as manure. The deficiencies are, 1st, the small space of the trial, 2d, the want of actual measurement of the quantity of the manure, (which was designed for and supposed to be at the rate of 30 bushels per acre; 3d, that it was on marled land, and no other; and 4th, and the most important objection, that the earth used contained a very considerable proportion of selenite, or gypsum, in very hard though moderately small crystals, which perhaps did not entirely dissolve, for years, and are not yet altogether used up by the crops, and so lost to the land. Thus it is impossible to judge whether the very obvious and profitable results are owing to the green-sand, or to the large quantity of gypsum (of the latter of which there must have been at least 4 bushels per acre) or to both, acting in connexion with the marl before applied. Capt. H. H. Cocke, (U. S. N.) the proprietor, stated that he made this rough experiment in the belief that the *gypsum* and not the *green-sand* was the valuable ingredient of the earth as manure. He also applied some of the same to land *not marled*, and found no benefit. He has since dressed some 30 or 40 acres with the same manure, and as he thinks with good effect; but as no precision was used in leaving a marked or regular boundary line, the effect could not be seen or appreciated at the season when we recently looked at the ground. We hope that Capt. Cocke will commence and carry through accurate and varied experiments, so as to show not only the value of this remarkable body of manure on his land, but also to show which is the fertilizing ingredient, and under what conditions it acts, or fails to act.

2. *Apricot tree in marl.*—At Evergreen, repeated attempts to raise apricot trees near the house had been unsuccessful. The trees died young, after bearing badly. The soil is a rich loam, on a clay subsoil. Some years ago, there was again a young stock of 5 or 6 trees, of suitable size to transplant. For experiment, one of them was transplanted to a walk, made of shell marl, (as a substitute for gravel,) and which was so compact and hard that it required good strength applied to the grubbing hoe to dig the hole in which to set the tree. The hole did not extend deeper than nor beyond the marl, and therefore the roots were placed exclusively in this hard bed of shelly matter. This tree has since been vigorous and grows well, and has begun to bear well. All the other trees, left in good and rich soil, declined, from the attacks of insects apparently, and not one of them is now alive.

The supposed cause of the benefit of the marl is that it cannot be penetrated and made a harboring place for the worm which bores into the tree near the crown of the roots, and the curculio which bores into and destroys the fruit while green. It has been already known in Delaware, (and was published in the Farmers' Register,) that laying about a bushel of marl to the roots and around peach trees, as they stand, (after laying bare the upper part of the upper roots,) was very beneficial to them. But planting them (and all other stone fruit trees) in a bed of marl must be a much better mode, if (as appears from the single fact above cited,) such a soil is not too calcareous for the health of the tree.

For the making of this experiment, as well as for the verbal report of it, we are indebted to Mrs. H. H. Cocke.

3. *Experiments with poudrette.*—Besides the report of Mr. Nicol (at page 97) of the ineffective application of *poudrette* last season, at Sandy Point, similar verbal reports have been made by Messrs. Robert G. Strachan and David Dunlop, of trials on their respective farms near Petersburg. The poudrette used by all was three barrels sent to us as a present, for the purpose of being tried, by the manufacturer, Mr. D. K. Minor, of New York. The supply was received too late for a full trial, as the corn had been generally planted. We made the best disposition of the manure, to three farmers who took pains to make as full trials as the advanced season permitted; and we regret to say that neither of them found any perceptible benefit. Still there can be no doubt of the great richness and value of the raw material from which poudrette is prepared, nor of the prepared article, if the mode of preparation be such as to secure from waste the fertilizing principles. If the fresh human excrements were mixed or covered, with marl, or any mild calcareous earth, we should warrant the preservation of the principles and the value of the manure.—Ed. F. R.

REMARKS ON THE MAKING, PRESERVING AND APPLYING OF MANURES.

To the Editor of the Farmers' Register.

Sandy Point, February 26, 1842.

In the January number of the Register is an "Essay on the making, the preserving, and the applying of manures," on which I would take the liberty of making a few remarks. Passing over the preliminary observations of the writer, I will begin with his stable management. I am not aware that any farmer or owner of a horse, who pays a due regard to his own interest, the health and comfort of his horse, or to the most economical mode of making manure from that source, is in any doubt as to "how long this [stable] litter ought to accumulate before it is removed," and that is that it should be removed every day. The writer of the essay is, however, "of the opinion that it ought to remain until by its great heat it endangers the health of the animal." If stable manure, by its accumulation, and consequent and unavoidable fermentation, should become at all offensive or deleterious to the health of the horses themselves, that deleterious tendency must be in operation from the moment such an accumulation commences; nor can any thing prove more injurious to the health, or more entirely destructive to the comfort of the horse, and certainly none more slovenly on the part of the farmer, than the too frequent habit of many in allowing manure to accumulate in the stable. The essayist's plan of keeping "the stables clean, not by throwing out the old mass, but by putting in frequent supplies of fresh litter," is something like concealing filth by a coat of paint, and has nothing that I know of to recommend it. By the essayist's own admission, the health of the horse is endangered by the practice, and I know from experience that it is not the most economical mode of making manure, and that in scarcely any other position will stable manure become sooner fire-fanged and injured. In Loudon's Encyclopædia of Agriculture is the following remark. "The dung should be removed [from the stable] if possible wholly without the stable as soon as dropped: for the exhalations from that are also ammoniacal, and consequently hurtful. To this cause alone, we may attribute many diseases, particularly the great tendency stable horses have to become affected in the eyes."

The essayist gives the preference to the feeding of cattle in pens, and subsequently states, "here also, great cleanliness ought to be observed, which can easily be secured by frequent supplies of fresh litter." In pen-feeding, with the most ample and frequent supplies of litter, I have never yet been able to secure that amount of cleanliness so desirable to the health and comfort of the animals so fed. Cattle on whom there is no demand made either on their labor or produce,

may thus be kept in tolerable plight; but milch cows and working oxen can never be subjected to this mode of feeding with benefit to themselves or profit to their owners; nor do I think that a larger or equal amount of manure can be made by pen feeding, than can be made by the same number of cattle stall-fed, daily cleaned, and fresh littered. I believe, by the experience of those who have tried both modes, the preference is given, in point of quality if not quantity of manure, to that from stall-fed cattle.

The essayist's mode of feeding hogs is not such as I think would suit the judicious hog breeder. Filthy as the general habits of the hog are supposed to be, it is an animal that is greatly benefited by cleanliness in keeping, and especially in feeding. As a manure raiser, the hog is certainly a valuable animal, and will amply repay his owner for plentiful supplies of litter, and for having his sty or pen frequently cleaned out. The supplying, however, of hog-pens with "scrapings of roads, ditches, &c., or of rich deposites of mud," is, I think, at best of doubtful economy; and in a majority of instances the labor of hauling and depositing such materials in the pens is unnecessary, if not injurious. If the deposites of mud, &c., are rich, why not haul them at once to the fields to be manured? The fermenting of either of them in the hog pens cannot be attended with any benefit, unless they contain a large proportion of inert vegetable matter, approaching to the nature of peat, which in this climate very rarely occurs. In the Farmers' Magazine, vol. xv., p. 351, are the following remarks: 'Making composts, then, of rich soil of this description, with dung or lime, mixed or separate, is evidently, to say the least of it, a waste of time and labor. The mixture of earths of this description with dung produces no alteration in the component parts of the earth, where there is no inert vegetable substances to be acted on; and the mixture of earth full of soluble matter with dung and quicklime, in a mass together, has the worst effects, the quicklime decomposing and uniting with the soluble matter of the earth as well as that of the dung; thus rendering both, in every case, less efficient as manures, than if applied separately from the quicklime, and even the quicklime itself inferior as a manure for certain soils, than if it had never been mixed with the dung and earth at all."

The essayist's theory, "that liquids are quite as necessary, and even more so, in exciting and hastening the decomposition of the litter than the solids are," appears to me unqualified. That moisture is necessary to induce fermentation cannot be doubted; but it is equally certain that an excess of moisture is destructive to and affords to the farmer the best means of checking and preventing injurious fermentation.

On the preserving of manures, the essayist observes, "As a general rule, manures ought always to be used, or at least placed in a situation to be used, as soon as thoroughly made;" and subsequently occur the terms, "properly made," "fairly made," "fully made." I would ask the writer, when is manure thoroughly, properly, fairly, fully made? On this point much diversity of opinion prevails. If I, from some experience, might venture to give an opinion, I would say that the slighter the degree of fermentation which takes place before manure is applied, as a general rule, the better. In colder climates, the bringing on of an incipient fermentation in manure before its application to the soil may be a desirable object; but in this climate the difficulty appears to me to be, with the judicious farmer, not in obtaining or facilitating but in preventing fermentation. On this subject, and for the climate of England, Davy speaks as follows:

"A slight incipient fermentation is undoubtedly of use in the dunghill; for by means of it a disposition is brought on in the woody fibre to decay and dissolve, when it is carried to the land, or ploughed into the soil; and woody fibre is always in great excess in the refuse of the farm.

"Too great degree of fermentation is, however, very prejudicial to the composite manure in the dunghill; it is better that there should be no fermentation at all before the manure is used, than that it should be carried too far. This must be obvious from what has been already stated in this lecture. The excess of fermentation tends to the destruction and dissipation of the most useful part of the manure; and the ultimate results of this process are like those of combustion.

"It is a common practice amongst farmers to suffer the farm-yard dung to ferment till the fibrous texture of the vegetable matter is entirely broken down, and till the manure becomes perfectly cold, and so soft as to be easily cut by the spade.

"Independent of the general theoretical views unfavorable to this practice founded upon the nature and composition of vegetable substances, there are many arguments and facts which show that it is prejudicial to the interests of the farmer.

"During the violent fermentation which is necessary for reducing farm-yard manure to the state in which it is called *short muck*, not only a large quantity of fluid, but likewise of gaseous matter, is lost; so much so, that the dung is reduced one-half, or two-thirds in weight; and the principal elastic matter disengaged is carbonic acid, with some ammonia; and both these, if retained by the moisture in the soil, as has been stated before, are capable of becoming a useful nourishment of plants."

The essayist's observation on the best mode of applying manures, "that he has come to the conclusion that the application of rotted manure as a top-dressing, and the coarse and unrotted to be immediately ploughed under," is contrary to the experience and practice of many intelligent and observant farmers. The shortest manures are doubtless the best adapted for winter and spring application, for any hoe crop immediately following. For example, the application of coarse litter, such as straw or corn-stalks only partially decomposed, to a field previous to planting corn, will cause serious impediment in the subsequent culture of the crop, and without any appreciable benefit to this or the following crop. On the other hand, the application of such manure, and also of dry straw, leaves, &c., which have undergone no previous fermentation, as a top-dressing on clover, is attended with the happiest effects, both to the clover and succeeding wheat or corn crop. I have seen finely rotted manure, dry straw from the stack, and dry and recent leaves from the woods, applied to clover side by side, and the best results were from the covering of dry straw. I have also seen young wheat top-dressed with pine

leaves (on marled land) with benefits which, though of course less in degree, were as distinctly marked as I have ever seen from the application of rotted stable or farm-pen manure. Numerous authorities might be quoted in support of using manure as a top-dressing, having undergone little or no fermentation, both from English and American writers. A frequent and valuable contributor to the Register, J. M. Garnett, esq., is one whose opinion must be familiar to every reader of your valuable periodical. A. NICOL.

AN ACT CONCERNING THE BOARD OF AGRICULTURE.

Passed February 3d, 1842.

Be it enacted by the General Assembly, That the members of the Board of Agriculture, authorized by an act entitled "An Act to establish a Board of Agriculture," passed March the twentieth, eighteen hundred and forty-one, be, and they are hereby, allowed the sum of three dollars per day each, for the time they have been, or may be, in actual session, and all reasonable expenses incurred by them, in travelling to, and returning from, their place of meeting.

All charges incurred by the corresponding secretary, postage paid by the members of the board, in discharging the duties imposed upon them, by the act aforesaid, together with the stationary used by the board, shall be allowed, and when admitted by the Governor, shall by him be caused to be paid by warrants on the Treasury.

This act shall be in force from the passing thereof.

[The foregoing act would have been published in the preceding number, but for the disappointment of two efforts, made by letter to different members of the legislature, to procure a copy.

Owing to the like want of authentic information, and relying upon the scant and incorrect notices in newspapers, we were somewhat misled, both as to the features and the progress of the bill, when our remarks thereupon were inserted in the January number. The errors, however, were unimportant, as the act now, such as it is, is completed, and speaks for itself.—ED. F. R.]

REMARKS ON SEEDS AND SEEDSMEN—SOWING SEEDS, CAUSES OF FAILURE, &c.

From the New Genesee Farmer.

The production of living plants from small grains of seed dropped in the earth is one of the most wonderful and beautiful operations of nature. When examined by the light of science, it is found to be effected by the combined agency of earth, air, moisture and heat; and to ensure success it is necessary that these four elements be combined in due but different proportions, according to the nature and habits of the different kinds of seeds. Hence arises the difficulty of causing some kinds to vegetate; and the uncertainty which gardeners generally feel respecting many of their crops until they see the young plants appear. Hence, also, arise most of the complaints which are made to seedsmen, and the censures which are unjustly cast upon them by inexperienced cultivators.

In order to explain this subject, and with a view to lessen the evil, the proprietor of the Rochester seed store has added the testimony of several highly respectable and successful cultivators in the country, and some accounts of their methods of preparing and sowing several of the most important kinds of seeds that are liable to fail with careless management.

The editor of the Albany Cultivator, speaking on this general subject, says:—

"Seeds often fail to grow; and the seedsman is often faulted, for vending bad seeds, when the cause of their not growing is owing to the gardener or planter. To induce germination, moisture, atmospheric air, and a certain temperature, are indispensable; and it is also requisite that light be excluded from the seed, until the nutriment of the seed is exhausted, or until the root can draw nourishment from the soil. The first effect of the air, heat and moisture upon the seed is to change its properties—to convert its starch into sugar—into a sort of milky pulp, the proper food of the embryo plant. If at this stage, the seed becomes dry, its vitality is believed to be destroyed; but if these agents are permitted to use their influence, the contents of the seed swell by degrees, and the first point of the future root having formed, breaks through the shell in a downward direction, and about the same time the first point of the future stem comes forth in an upward direction. Air, heat, and moisture are as indispensable to the growth of the plant, as they are to the germination of the seed.

"Now it often happens, that when seeds are planted in fresh stirred ground, or when the soil is moist, they undergo the incipient progress of fermentation, and the earth not being pressed upon them, and dry weather ensuing, the moisture is abstracted, and the seeds perish. Too much moisture is also often destructive to the vital principle of seeds—and others again are buried too deep to be vivified by solar and atmospheric influence.—The first object in planting, therefore, should be to place the seed just so far under the surface, and so to cover it with earth, as shall barely secure to it a constant supply of moisture. There are many seeds, as of the carrot, parsnip, orchard grass, &c., which if not previously steeped, or the soil well pulverized and pressed upon them, fail to grow for want of moisture. Hence, in sowing orchard grass, it is found prudent to spread it upon a floor and sprinkle it with water, before it is sown, and to pass a roller over the ground after the seed is sown; and hence, in light garden mould, it is advisable to press, with the hoe or spade, the earth upon all light seeds after they are sown."

On sowing flower seeds.

David Thomas, an experienced and very successful florist, remarks:—(N. G. Farmer, vol. 1, p. 56.)

"For large seeds, like the bean or the pea, a coarse soil is well adapted, as they can force their way to the surface from any moderate depth: but small seeds require different treatment; and we

lay it down as a safe rule, the finer the seed, the finer should be the soil.

"How does nature, exemplifying Supreme Wisdom, sow her most delicate seeds? She scatters them on the shady ground, trusting to the rain or the frost to cover them, (of course slightly,) and they germinate before the sun has acquired power enough to scorch them. The dust-like seeds of the orchis and cypripedium sometimes grow in beds of damp moss.

"Common garden loam, whether clayey or sandy, is much improved by a dressing of vegetable earth from the woods, well mixed before planting. If prepared in the preceding autumn, and pulverized by the frost, all the better.

"Such a soil is favorable to seeds of almost any kind, but *essential* to the finer and more delicate sorts. The preparation of the soil alone, however, is not enough. Fine seeds may be smothered if covered from more than one-eighth to half an inch deep; and their short roots may be parched if exposed to the sun except in the morning and evening. To a *fine soil*, therefore, we must add the protection of *shade*, and in time of drought, a regular supply of *moisture*. If the seeds are sown in an open border, a sprinkling of water in the evenings is best, but carefully abstain from applying so much as will bake the ground."

On preparing and sowing onion seed.

W. Risley—(N. G. Farmer, vol. 2, page 38,) says:

"First soak the seeds in water from six to twenty four hours—some seeds being slower to admit moisture than others, is the difference in the time required. After soaking, drain off the water, and mix the seeds with a sufficient quantity of earth to absorb the moisture remaining on the seeds; stir them often that they may vegetate evenly, and keep them in a moderate degree of warmth and moisture until they are sprouted, when they are ready to put into the ground. If the weather should be unfavorable, put the seeds in a cool place, which will check their growth. * *

"It was left in that situation until the time of sowing. In April, as soon as the soil was sufficiently dry, the ploughing was commenced, and the second day, at night, the sowing was finished, with seed prepared as before stated. *In one week the onions were up*, rows were soon visible near twenty rods, and no weeds yet appeared. The operation of stirring the soil with rakes and hoes was then commenced, and the weeds were not suffered to grow during the summer. (It is a mistaken notion that it is not time to hoe a garden until it is green with weeds.) The first of September the onions were harvested, and the product was over *two thousand bushels* of fine onions from two and a half acres."

On soaking mangel wurtzel seed.

J. Rapaljee says, (N. G. Farmer, vol. 1. p. 149,) "I prepared half an acre of land for mangel wurtzel, and obtained the seed from your agent at Canandaigua. After soaking the seed one day, I commenced sowing; but rain came on, and the soil being rather clayey, it was a whole week before I could sow the remainder. The seed was soaking all this time, and supposing it was spoiled or injured, I sowed it thicker than usual, and had not enough to finish the ground. Accordingly I sent to the same place and got more seed, and sowed the remainder without any soaking; so that part of my ground was sowed with seed soaked one day, another part one week, and a third part not all.

"Now for the result:—The part soaked one week, came up first, and much too thickly;—the part soaked one day, came up slowly and very thinly; while the part not soaked, did not come up at all. Thus showing conclusively, the necessity of thoroughly soaking these seeds, and the little danger there is to be apprehended from soaking too long. I am confident that inattention to this subject is the most frequent cause of the failure of the mangel wurtzel and sugar beet seeds."

William Garbutt, (N. G. Far. vol. 1. 20,) says, "much complaint is sometimes made of mangel wurtzel and sugar beet seed failing to grow. These seeds are not quite as sure of vegetation as some kinds; still, if rightly prepared, and sown when the ground is in good condition, before the weather becomes too dry, they will very seldom fail. The seed should be *soaked* in soft water, standing in a warm place, *for three or four days* before sowing. The shell of the seed is very hard, and requires a long time soaking for it to become softened so that the germ can burst it open. I have sometimes known it fail after being soaked, owing to late sowing and dry weather."

Planting too deeply. In vol. 1, p. 97, W. R. Smith states that he "planted half an acre of mangel wurtzel with two pounds of seed from the Rochester seed store. In a few days some scattering plants made their appearance. * * * Well, nearly two weeks after, I was surprised to find a fair number of plants just peeping through, and from their weak and thin appearance evidently wearied with their journey to the surface, which they never could have reached if the soil had not been light."

Parsnip, carrot, celery and parsley seeds are all slow to vegetate, and if sown late, and dry weather succeeds, they will not often come up. These seeds should be sown early, in fine soil, rolled or pressed down and kept moist. Mr. Geo. Sheffer of Wheatland, raises large quantities of carrots for feeding. He soaks the seed 48 hours, then rolls it in plaster, and when sown covers it from one half to three quarters of an inch deep.—(N. G. Far. vol. 2. p. 181.)

Cucumber, melon and squash seeds, seldom lose their vitality by age or otherwise, but when sown they often fail to grow, owing to the ground being cold or wet. These, and some other seeds, will invariably rot if sown too early—before the ground is sufficiently warm. *Lima bean and sweet corn* often fail from the same causes.

Egg plant seed will not vegetate in the open ground—it requires a good hot-bed.

Locust seed must be thoroughly scalded, by pouring boiling hot water and letting it soak 24 hours.

SUCCESSFUL CULTURE OF SILK IN 1841.

Extract from a letter from Robert Sinclair, sen., near Baltimore.

To the Editor of the Farmers' Register.

* * * I succeeded admirably in raising silk the last season. I sold for cash to the amount of

$357; and I am fixing to raise largely next season, having a good house well fixed, plenty of trees, and 80 ounces of good eggs, hands about me who have now had some experience, and from some account of cost kept last season, I am confident that, after having the three above requisites, I can raise silk in the cocoon state at $1 per bushel, or say what when reeled will make one pound. * * * * * *

ON THE CAUSES OF DETERIORATION OF THE WHEAT CROPS IN VIRGINIA.

For the Farmers' Register.

The causes which have led to the failure of the wheat crops in Virginia, for a succession of years, deserve the deep consideration of every farmer; and I am gratified to perceive that the subject is becoming one of public discussion. It is with the view of contributing my mite towards the elucidation of these causes that I submit the annexed observations; though I have had but little connexion with practical agriculture for several years.

For the last twenty-six years, during which I have been an observer of the progress and maturity of the wheat crop, a very great but gradual change has taken place in the time of ripening. In 1816 and '17 my harvest of the later varieties of wheat, growing on a heavy and rather slow soil, was commenced on the 17th and 18th of June. The earlier varieties, the old purple straw and May wheat, then extensively cultivated, but now extinct, usually came to the scythe from six to ten days sooner. Ten or fifteen years previous to that period, I have heard that the May wheat was frequently harvested in the month from which it derives its name. From 1816 downwards my memorandum book shows that the harvests became later and later; and last year, in the region of country in which I reside, there was scarcely a field of wheat ripe enough to be reaped before the 25th of June, and the harvest extended several days into the month of July. It was perhaps the latest harvest that we have ever known, though there have been several seasons in which a large portion of the wheat has not been in a condition to cut before nearly the close of June.

Another fact, which all farmers have doubtless observed, is that in proportion as the period of harvest is protracted, whether by the season or the variety of wheat cultivated, the more indifferent is the crop. A late crop is almost invariably attacked by the rust, which is decidedly the most formidable enemy we have to contend with. A long series of observations on the weather has convinced me that, from about the 20th of June to the 1st of July, we have a regular accession of hot, sultry weather, accompanied by frequent showers, most disastrous to the wheat that has to ripen during that interval. This state of the atmosphere recurs with as much uniformity as the "long spell in May;" and equally with the latter may be considered as in accordance with the laws which influence our climate. In the one, for the most part, the wheat is in flower; in the other it has to mature. When the harvests were earlier, as they were twenty years ago, the wheat was generally in blossom before the recurrence of the wet season in May, and there was consequently less of scab and blight, and open shuck, than of late years. The organs of fructification had performed their office before they were mutilated by the storms of the season. And in regard to the last half of the month of June, what farmer has not frequently beheld his fields of wheat wither and dry up rather than ripen, beneath the influence of the scorching rays of the sun? Even if it escapes the rust, which it seldom does under such circumstances, the weather is too hot for it to come regularly to maturity; and hence a light product, with very rare exceptions, must be the consequence of a late crop.

The obvious inference to be drawn from these facts is, that farmers should exercise the utmost precaution in the selection and preservation of their seed, and in the cultivation only of the earlier varieties. In the time of flowering they should aim to anticipate the long spell in May; and in the time of maturity, the sultry spell of June. This course, judiciously followed, will go far towards arresting the evil. But it will require care and perseverance. It was formerly practised with great success by the manager at Maiden's Adventure, in Powhatan, who selected every season from the earliest ears in his fields a bushel of wheat; and preserved his May wheat in the highest purity for a long time. His neighbors, for many miles around, were in the habit of sending to him for seed. The English farmers, by similar means, perpetuate the purity of their wheat, and keep each variety entirely distinct. Their example is worthy of all imitation; for as the failure of a crop of wheat in England is attended with far more disastrous consequences than it is in this country, it may be reasonably inferred that they have learned well how to multiply guards for its security.

The means here indicated are within the reach of all; but they do not constitute all that is necessary to the highest state of productiveness of the wheat crop. A great deal depends also upon the *soil;* so much so that the opinion is very generally entertained that wheat soon degenerates in our soil and climate. Hill Carter, in a late communication to the Farmers' Register, directly avows his belief in this doctrine; though William Carmichael appears rather indisposed to subscribe to it.

A highly cultivated plant is like a highly improved animal: neither will bear neglect without manifesting a tendency to deteriorate. Each is in some measure an artificial production. The race horse requires the greatest care, to be maintained in the full possession of his qualities; the short-horn cattle can only thrive on the most abundant and nutritious fare; and in like manner, the plant in its state of amelioration can only be kept up by a supply of that food which is indispensable to its full developement.

In respect to climate, the changes which the seasons have undergone in the last 25 or 50 years must be almost imperceptible. Natural laws are so uniform in their operation that we are hardly justified in supposing that there has been any departure from their ordinary course. If there has been any change, it has been one of amelioration, and therefore propitious to the earlier maturity of plants. But our soils by a long train of cultivation may have become partially or entirely ex-

hausted of that particular aliment which is essential to the production of wheat in its highest degree of purity. If they are thus exhausted, then we can no longer expect to derive perfect crops from imperfect seed. As a general rule, like will produce its like; a robust offspring is not the product of diseased parents. It is well known that it is only on lands containing lime, in some form, that the grain of wheat can attain its perfect developement. If the proper care had been exercised in the selection of seed, and the wheat grown on land adapted to its perfect production, it appears impossible that there could be any degeneracy, or that it should be later in reaching maturity now than formerly. But our soils, instead of being limed, have been enriched by putrescent matter; and in most instances the seed is probably saved from the most luxuriant growth, from rich lots or highly manured fields. The tendency to run to straw is thus encouraged and perpetuated instead of being corrected. Rust, and blight, and smut are the natural consequences of this state of plethora; the time of ripening becomes gradually protracted; and the farmer wonders why his wheat, that looked so promising in the spring, should be such a total failure at harvest.

In the first vol. of the Farmers' Register there is a translation of a highly interesting paper by Professor Bronn, of the University of Liege, "on the influence which the seed exerts on the quantity and quality of the crop produced from it, according to the different nature of the soil and climate from which this seed has been procured." From a number of well-established facts in vegetable physiology, he deduces the following law: "that every thing which favors the disproportioned growth of vegetables, opposes or retards their propagation or formation of fruit; and *vice versa*, the formation of fruit is hastened and forwarded at all times when exterior circumstances prevent the full developement and disproportioned growth of the stalk." The whole paper is of great interest to the agriculturist, and I would suggest its republication at a convenient time.*

This physiological principle furnishes us with the true theory respecting the important subject of a change of seed; and in the absence of a soil adapted to the wants of the wheat plant, as well as the means of rendering it so, our chief reliance will be found in obtaining seed from proper localities. There is scarcely a farmer who does not change his seed wheat, more or less, every year or two. Indeed, his discouragements have been so great, that he is continually on the watch for something new, in the hope that he will at last find a kind of wheat that will flourish on his land. Let him proceed upon correct principles, and there can be no doubt that he will derive material benefit. Supposing his lands to be destitute of calcareous matter, as all our soils are, he should obtain seed from a limestone country. His object is to reduce the quantity of straw, which is already too great on our improved lands, and increase the quantity of grain. A calcareous soil does not yield a great growth of stalk, and the qualities of the plant are transmitted to its offspring for two or three generations. That the qualities are thus transmitted is asserted by Professor Brown, and established by repeated experiments, both in the culture of wheat and other plants.

Some years ago I travelled, during harvest time, through the western part of New York, one of the finest wheat growing regions in the United States. Its soil contains so much calcareous matter that it is frequently found to effervesce when mixed with acids; and accustomed as I had been to witness the growth of wheat on lands made rich by putrescent manure, far more luxuriant than what I saw there, their crops did not present a very imposing aspect. Fields which I was told would yield from 25 to 30 bushels to the acre, would not have been adjudged in Virginia to produce more than 10 or 12 bushels. This is the kind of growth we should endeavor to secure; and next to having calcareous matter in our lands it is most desirable to have seed produced on calcareous soils. From New York then, or from Pennsylvania, or the valley of Virginia, or any other limestone region, we should renew our seed. And the facilities now offered, by the numerous seedsmen in our towns, are so great, as to place it within the power of most farmers to obtain from time to time a few bushels, which is all that is requisite for a supply.

Every farmer has witnessed the eagerness with which new varieties of wheat have been sought after; and he has also experienced the disappointment of finding them to become entirely worthless in the course of a few seasons. I could perhaps enumerate some ten or twelve varieties that have been cultivated within the last twenty-five years. Each was highly extolled, and all produced well for a time. We also know that on some farms, or in some neighborhoods or districts, a variety of wheat continues to be cultivated with success longer than in other neighborhoods. The only reason for this result that I can conceive is, that where a given variety flourishes longest, there the soil is best adapted to its healthy growth. The owners of such lands have it in their power, at a moderate cost, to render them in a great measure exempt from that sterility which, as it regards the production of wheat, has overtaken the most of our soils.

A striking case in point, in support of the view I have attempted to explain, in relation to a change of seed, is offered by the famous Italian spring wheat which attracted so much attention in Virginia a few years ago. For the first season the product was good; in some instances it was even extraordinary. Hence it was inferred that spring wheat might be cultivated permanently in our hot climate. The whole amount of success that attended its culture, as subsequent experience fully demonstrated, was to be ascribed to the quality of the seed, which being obtained from a soil admirably adapted to the perfection of the wheat grain, gave it an ephemeral vitality, during a favorable season, which enabled it to overcome the influence of opposing causes. After the first year, there were few cases in which more than the seed was reaped.

But the most interesting and conclusive facts in support of the value of a judicious change of seed were furnished by the late Benjamin Harrison, in 1838. [See Farmers' Register vol. vi. page 129.] He several times obtained a few

* This request shall be complied with in the next number.—Ed. F. R.

bushels of seed from Frederick county in this state, and the result was uniformly a great yield the first and second years, and a very good yield the third; after which his crops from the same seed rapidly deteriorated. Out of a number of experiments, the only failure he sustained was in the last trial he made; to wit, in 1841. He represented the wheat as ripening very late, and being attacked by the rust. But I have shown that late wheat has no chance to come to perfection, especially during such a season as the last;—the influence of climate being then fully sufficient to counteract the action of other causes, how favorable soever they may be.

I am aware that the editor of the Farmers' Register considered the results of the above mentioned experiments as in conflict with Dr. Bronn's principles. But the application I have attempted to make will, I hope, satisfy him that they are in perfect harmony with them. We assume that the seed was obtained from a soil well adapted to its developement, and transferred to another soil less favorably constituted. And so far as the influence of climate was concerned, the change was likewise to one of a less genial character. It follows then of necessity, that the result could not have been otherwise than comparatively favorable, provided there was no extraneous cause to produce disaster.

It has been thought by many persons that old wheat was better for seed than new. It is a well known fact that many species of plants grow with less vigor from old seeds. The chief value, if value there be, may therefore consist, in the case of wheat, in the diminished tendency to make straw, and in the greater tendency to produce grain. This point can be well observed and the comparative result reported by E. Ruffin, Jr., who has detailed a series of interesting experiments in the last number of the Register, some of which, and this amongst the rest, are yet in progress. It would also be gratifying to many readers to be informed whether the old wheat suffers as much from the depredations of the Hessian fly.

After all, however, the only effectual and permanent remedy for the disasters which have befallen the wheat crop, is to improve the land; to impart to it those constituents of a good soil in which it is obviously deficient. All other means are mere aids and expedients, valuable as far as they go, but of temporary duration. T. S. P.

ON THE CULTIVATION OF THE CORN CROP.

To the Editor of the Farmers' Register.

Chericoke, March 18th, 1842.

When we were last together, you expressed a wish, that I would furnish for publication in the Register, my method of cultivating the corn crop. This, as you wish it, I have no hesitancy in doing, and the more readily, as I consider all tide-water farmers labor under a debt of gratitude to you, for your "Essay on Calcareous Manures," and I may add, for the ardent, and zealous labors of a well spent life, so far as it has gone, in behalf of agriculture, which do all they can, they can never repay. In saying tide-water farmers, I do not at all mean that no other part of the state or country has been benefited by your labors, as I believe all have, or could have been, had they chosen to profit by the precepts you have so long and so ably inculcated, whether it is east, or west, north, or south; for the same great truths and principles that are applicable to our section of country, as to the improvement of soils, under the same circumstances must be applicable to another, and indeed to all; for the first thing, and the greatest desideratum with all intelligent and judicious farmers, I presume must be, if it is possible to make their lands rich, or if rich, to keep them so; for it is only by rich lands that a farmer can make or keep himself rich. The first thing then I should think a judicious man would do, in taking possession of an estate, if it was sterile, would be to inquire into and ascertain the cause of its sterility, and if possible to correct it; and if on the other hand he found his lands already fertile, that very rare occurrence in lower Virginia, it would be equally prudent in him to ascertain its true character, and the way in which this fertility could be maintained. And now (having had a pioneer to go before to point out all these things to us, to enable us to do, what without the aid of science never could have been done, viz.: to make a naturally poor soil rich, and to point out to us, too, that where we most needed the fructifying principle, we had it in most abundance,) I again ask the question, is not he that has done so much for us, deserving of all the praise, and all the gratitude we can give? I trust, sir, you will pardon me for this digression, but it is really what I feel, and what every tide-water man should feel, in lower Virginia or wherever marl or lime is attainable.

I will now, sir, resume the subject for which this communication was intended, to wit, my method of cultivating corn; although I do not know I that I shall advance any thing new, or that any body will fancy my way preferable to his own; as corn making is a subject upon which most farmers think their way is preferable to all others, and I dare say most of us are rather too well satisfied with our own notions, and way of doing things, else perhaps agriculture would go ahead faster than it does, and more science would be brought to its aid. And again the same system of tillage applicable to us, on our light lands, might not be so on different soils. But as I think the method that some of us pursue in this neighborhood a good one, wheresoever applicable, I will even say on. In the first place, then, I delay as long as possible in breaking up my corn land, so as not to finish until the planting season arrives. I am aware that in this practice I am singular, but nevertheless I think it a correct one. One very important reason with me is, that it saves from sprouting a vast quantity of clover seed, that would otherwise be lost; as every one, I presume, has noticed upon early fallowed clover land how thickly the seed came up in the spring, which all of course must be killed in the cultivation of the corn crop. Another reason is that it saves at least one month's work in the after-culture of the crop, as the weeds and grass seed do not find their way up at all, generally speaking; as from the time the ground is ploughed to the laying by of the crop, the drags, cultivators, and ploughs are always going. And thirdly, but not lastly, as I could give other reasons, I think land injured by an exposure to the

winter's frosts and wind. The covering with which nature has clothed it, as a protection from the winter blasts, keeps it, I think, in a better state for the summer's crop, than when it is exposed by a fall fallowing. If the land is stiff, and is ploughed in the fall, it requires another in the spring, and is then almost sure to be ploughed too wet; and I really think it a fallacy, in supposing that decomposition of the vegetable matter turned under in the fall can take place in the spring, before the return of warm weather.

When, however, my ploughing is done, it is done in the best way, with large ploughs, as I do not design any thing that is turned under shall again see light, until the three-horse ploughs are again brought into operation for a fallow for wheat. The depth of my ploughing is regulated by the depth of soil, as I never designedly turn up a *caput mortuum*.

If the land is any other than very light and dry, we bed in fifteen feet beds, so as to leave three corn rows on a bed. As soon then as the ploughing is finished, we put on the drags, and dress the surface as nicely as possible. The ground is then laid off in five feet rows, with a trowel hoe plough, and the corn planted as soon after as possible; beginning as soon in April as we can. We plant by a string going across the rows, or beds as may be. In common land we plant at the distance of three feet the narrow way, in pretty good land two feet, and in good land three feet with two stalks to each hill. I think it decidedly better to double or triple the stalks in the hill, than crowd it too much the narrow way, as I think corn, as well as all other grain-growing plants, requires air, as much as sun, or rain. As soon as the planting operation is finished, the drags go to work again, so as to get over the crop by the time it begins to come up. As soon as it is up, we put in the single horse cultivators, (five teeth, square cutting edge, and working square to the front, about two or two and a half inches wide, fixed *echelon* fashion in one beam, the horse pulling by the other,) generally I believe called the X cultivator, (the only kind of all the varieties of that plough I have ever seen worth a cent.) Then we run as close to the corn as possible, going three times in a row, generally getting over twice before the corn is high enough to take earth, say knee high, or more. As soon as it is, we put in the single-horse plough, lapping the earth on the corn; we now put on the hoe hands, (having previously thinned as soon as it was large enough to bear the operation,) and that the ploughs may be enabled to keep way for the hoe hands, we now go on with four furrows. The weeding, by the way, is only a nominal thing to level the land, to straighten any stalk of corn the ploughs or other causes may have bent. As soon as we finish with four furrows, we then go back and split open the middles. This brings us to about the beginning of harvest, when the cultivators are again put in, and run to level down the beds, and to keep down the young grass, and to keep the land always open for the reception of light, air, and moisture, the great nourishers of vegetation. We go over the crop with the cultivators after using the plough once or twice before we finish, according to the forwardness of the crop. We cease then until the corn is in full shoot and tassel.

The practice of backing off the land from the young corn, as soon as it comes up, with large or small ploughs, I think cannot be too much deprecated. It is, I know, the prevailing method of cultivating corn in this section of the state; and I know, also, that very many good crops have been made in that way. Corn is a very vigorous plant, and with good cultivation, in good land, work it as you may, will bring a good crop. But still, I think the practice of backing off the land from the young corn a very bad one, as it evidently gives us double the hoe work, exposes the grass seed and roots to the light and air, which vegetates them, and starts them all to growing, and moreover brings up the vegetable matter just turned in, it don't matter whether of fall or spring, then to be exposed to the air to dry, and interfere with the after cultivation the balance of the year, instead of remaining under the earth, to decompose, preserve moisture, and afford food for the growing plant. The great secret, if any there is, in cultivating the corn crop, is always to keep the surface stirred and clean, never suffering a crust to form on the land, that thereby the roots of the plant may have free access to light, and air, and all the moisture it can get, whether from rain or dews, and no weeds or grass to take from the growing crop. To those who use cultivators, in the tillage of the corn crop, I would advise them always to keep ahead of the grass, as, if the grass gets ahead of them, the cultivators will not subdue it.

I have followed the above method of cultivating the corn crop for some years, and have succeeded very well with it, and have never had a grassy field since I commenced it. It saves time, much hoe work, and I think makes the crop more sure. Indeed I do not think it takes more than half the labor of the ordinary method; and to those who sow small grain in the fall after corn it gives a clean cornfield. If, peradventure, this communication should fall under the eye of any other than one of the family of the "good-enoughs" I would advise him to try it, provided always his land, &c., suit.

CORBIN BRAXTON.

PAINTING HOUSES.

From the Farmers' Cabinet.

It has long been a subject of inquiry as to the best time to apply paint to the clapboards of houses for durability. Repeated experiments have been made, within twenty-five years past, which have resulted in the conviction, that paint applied between November and March will stand more than twice as long as that which is spread in the warmest weather. The reason is obvious; for in cold weather the oil and the component parts of the paint form a hard substance on the surface of the clapboard, nearly as hard as glass, and not easily erased or even cut with a sharp knife, and will not soon wear off; whereas paints applied in the months of July and August, and more especially if in a severe drought, the oil immediately penetrates into the wood like water into a sponge, which leaves the lead *nearly dry*, which will soon crumble off.

REMOVAL OF THE OBSTRUCTIONS IN RED RIVER.

To the Editor of the Farmers' Register.

I have this day received from Gen. Williamson, the contractor under the United States for opening the raft on Red river, a letter dated the 19th inst., saying that the obstructions were removed, and that the steamer South Western had on that day passed through on her way to Fulton, a flourishing town some two hundred miles above the raft, and that the Harrisburg steamer, with a barge in tow, was in sight, and would be very soon also through.

It is part of the contract under which the river has been opened, that it shall be kept open for five years, after which time the stream will be so wide as to enable it to pass its floating drift wood, and take the same care of itself as other rivers. At present the river is so lessened in width by accumulations of alluvial soil on the sides, from the lodgment of its drift timber, that it will take the current some time to wash out a space equal to the size of the river either above or below these obstructions; and it is during this time, and for this object, that the contract is continued for some years, so as to assist the current, where it may from time to time show that it is needed, in widening its bed. When this is effected, it is but reasonable to expect that the river will keep itself open within the raft region, as it has always done for 500 miles above it, and as it now does below it. The town of Shreeveport was built some years ago above one hundred miles within the removed raft, and the river has kept itself clear to that place. It is now removed for fifty miles above that place into the unobstructed river, and where it is 200 yards wide, and that for several hundred miles above.

The opening of this great river, which may now be deemed certain, will give an inlet for brisk trade to steam boats, in a passage of five days from New Orleans, into unquestionably one of the finest cotton countries of the United States, whether we regard climate or fertility of soil.

The lands immediately on the river are naturally dry, light, and easy of cultivation, and yield on an average of years from 1500 to 2000 pounds of seed cotton to the acre, and under favorable circumstances on particular acres has yielded more than 3000 pounds, and in corn as high as 75 bushels. In corn it yields from 40 to 60 bushels to the acre. These lands are all owned by purchase from the government, or claimed by settlers with a view to a purchase when they shall be brought into market.

There are large bodies of good oak and hickory upland, running parallel with the river and convenient to it, that can be had at government price, and are now in the market for entry. The produce is various, from 600 to 1200 pounds of seed cotton to the acre, but from 600 to 800 pounds cotton, or 20 bushels of corn, may be about a general average. These lands are easy to clear, and free, light and easy to cultivate, and the country generally well watered and pretty healthy.

This country is worthy a visit from the planter, (which can be comfortably and cheaply made,) as it is perhaps the only part of the United States, taking into consideration price and fertility, that will enable him to make reasonable profits on the present price of cotton, which, it is to be feared, is neither accidental nor temporary.

Mobile, March 12, 1842.

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EDMUND RUFFIN, EDITOR AND PROPRIETOR.

ASHES AS MANURE.

From the New England Farmer.

The following is from "the Transactions of the Society for Promoting Agriculture in the State of Connecticut" :—

"What experiments have been made with ashes? On what soils, for what crops, and for what grasses? What success has attended the use? Are leached or unleached ashes most beneficial as a manure? Do they equally suit upon the same soils, and for the same crops? In what quantities are they to be used?"

Mr. Atwater, of Wallingford. I have made use of leached ashes, as manure for crops and grasses, and find it excellent for both upon dry land. When my grass fails, I plough up my land, and the ashes serve again as manure for a crop, and afterwards for grass. But ashes have not benefited my wet land, that was unfit to plough; for though they in most instances introduce clover, yet the land will soon be covered with moss, when it is rendered unfit for any thing, and if it cannot be recovered from the moss by ploughing, it is injured instead of being benefited.

Mr. Tomlinson, of Milford. We have found leached ashes to be excellent manure for flax.

Mr. Parsons, of Durham. I have used unleached ashes for many years, as manure for Indian corn. I put a handful round each hill, soon after the first hoeing, and have much benefited my crop by this method, having frequently omitted some hills, for the purpose of ascertaining the benefit derived from the ashes. I have always found myself richly repaid both for the manure and for my labor. The greatest advantage has accrued when a rain has followed shortly after my applying the ashes.

Mr. Noah Fowler, of Guilford. I have found, from experience, that leached ashes is a very beneficial manure for wheat and rye. It appears to me to be a great preventive of blasts.

Mr. Andrew Hull, Jr., of Cheshire. I have received great benefit from leached ashes as manure for wheat and rye. But I have not found that it prevented blasts.

Mr. Holcomb, of Simsbury. I have made use of unleached ashes, as manure, for Indian corn, and have derived great benefit from it on dry land. Whenever I have used it for corn, where the land was wet and heavy, it has been of no advantage to the crop at all.

Mr. Wadsworth, of Durham. One of my neighbors planted a field with Indian corn, and applied unleached ashes to thirty-six hills. During the first part of the season, the corn on which the ashes was put appeared much better than that in the other part of the field, to which no ashes was applied. When the corn was gathered, the thirty-six hills, to which ashes was applied and thirty-six adjoining hills which had none were measured, and those which had no ashes were found to be the most productive and to have the superiority over those on which ashes was put. This was on heavy land. The same neighbor made the experiment on light dry land. A part of his crop of corn was ashed and a part was not. Here the ashed corn much exceeded the other.

Mr. Eli Bronson, of Waterbury. In June, 1792, I ploughed a grass field, of a light sandy soil, where much old wood was burned. The ground was very dry. After harvest, I ploughed this fallow again. The drought continued more severe than was perhaps ever known in the memory of man. I observed that all the spots where logs were burned were much more moist than any where else. This circumstance particularly attracted my attention, as I had been taught that ashes were of a hot, droughty nature, suited only to wet land.

In 1795, I planted a wheat stubble, which was new land and sandy soil, which had been thoroughly burned when tilled for wheat. Part of the corn was dressed with a handful of ashes to a hill, at the first hoeing; here, for the first time, within my knowledge, ashes failed of producing any beneficial effect.

Soon afterwards I planted a tough sward, part of which was ashed in quantity as above. The part dressed with ashes grew remarkably, while the other appeared languid and pale, as if grub-eaten, until the second hoeing, after which it began to recover and to thrive better; but it finally produced not more than half as much as the part to which ashes was applied.

From the experiments of myself and my neighbors, I formed the conclusion that not only on new land, which has been recently burned, but also on land which has been kept mellow by tillage for one or two past seasons, and where little or no undissolved vegetable substance remains, no visible benefit accrues; of which the following facts may be considered as farther illustration.

In 1796, I planted corn after rye, the land cloddy and full of stubble; one end of it was very tough, and was planted with potatoes; a few hills of the potatoes, and most of the corn were ashed; some of the corn was dressed with gypsum—all was benefited, but the potatoes much the most.

In 1797, I again planted corn on cloddy land, encumbered with stubble. I carted on barn-yard manure, not well rotted. I ashed a part, by which the crop was enhanced at least one third.

In 1798, I fallowed a lot, much exhausted by ploughing. It was a dry loam, with tender sward. Carted on barn yard manure, ten loads to the acre, and ploughed it four times. I sowed half an acre with wheat, and strewed over the half acre a small load of leached ashes, and eight or ten bushels of unleached ashes. The wheat at first grew surprisingly, and though it did not hold out according to its first appearance, it yielded eleven bushels.

In 1799, I planted corn on buckwheat stubble, loamy soil—I ashed a part of it when coming up, and omitted one row. At first there was an apparent advantage, but by hilling time it could scarcely be discerned, except at one end, where it was somewhat cloddy, and there it might be perceived at harvest time. The other part I dressed with

gypsum, leaving one row as before: the success was the same as with the ashes.

The same year I planted a piece of sward land, loamy soil, and dressed the corn with ashes, omitting one row, as in the other field; began to hoe the corn seven days after the ashes was applied, when the hill in the unashed row, which we crossed in hoeing, was every where noticed from being yellow, while the other was a lively green. After the second hoeing, a second dressing of ashes was applied on part of the lot, but without effect, even on part of that row, which was omitted in the first dressing. About hilling time, the unashed row began to recover; but finally yielded at harvest, little if any more than half as much as the adjoining rows.

The same year, I observed the like good effect on corn, both from ashes and from gypsum, on tough sward, and on cloddy land, as applied by my neighbors, in sundry instances.

I have often found ashes, both leached and unleached, to be very beneficial to grass on dry land, but not on wet. I have never found them useful on my garden.

From my experience and observation, I conclude that ashes is best applied on dry grass land, or on land newly ploughed up, or where shades have lately been taken off, or where grass turf or other vegetable substances remain undissolved: in each of which cases, there is contained in the soil food for plants, unprepared for vegetation. To effect, therefore, a speedy preparation, ashes is an important application.

Whether ashes do, in fact, prevent worms, or destroy them when corn is eaten by them, I have not been able to ascertain; though they have been often supposed so to do, when no evil of the kind has existed. I have often, when corn has appeared languid and yellow, as if eaten by worms, taken up whole hills and carefully examined both the roots and the earth, without discovering any signs of worms. In these cases, I have deemed the unpreparedness of the soil to be the only evil. Ashes is then a sure remedy. But if the land be well tilled, the weather be warm, and there be frequent showers, it will be well prepared, without ashes, by hilling time or sooner; but the corn will not recover the injury it has sustained for want of earlier preparation. Hence it follows, that ashes on ploughed land should be applied as soon as vegetation begins.

It is best to apply leached ashes as soon as corn is planted, while a team and cart may pass without injury to the hills. But whether unleached ashes can safely be applied before the corn is sprouted, is a question I am unable to solve.

The usual quantity of unleached ashes for a hill of corn is about a gill: but it is worthy of being observed, that where a greater or even a less quantity has been applied, the effect has been much the same. The effects of ashes and gypsum, so far as the application of the two has fallen within my notice, appear to be much the same.

TO MAKE HENS LAY PERPETUALLY.

From the Cultivator.

I never allow cocks to run with my hens, except when I want to raise chickens. Hens will lay eggs *perpetually*, if treated in the following manner. Keep no roosters [cocks]; give the hens *fresh meat*, chopped fine like sausage-meat, once a day, a very small portion, say half an ounce a day to each hen, during winter, or from the time insects disappear in the fall, till they appear again in the spring. Never allow any eggs to remain in the nest, for what is called *nest eggs*. When the roosters do not run with the hens, and no nest eggs are left in the nest, the hens will not cease laying after the production of twelve or fifteen eggs, as they always do when roosters and nest eggs are allowed; but continue laying perpetually. My hens always lay all winter, and each from seventy-five to one hundred eggs in succession. There being nothing to excite the animal passions, they never attempt to set. If the above plan were generally followed, eggs would be just as plenty in winter as in summer. The only reason why hens do not lay in winter as freely as in summer, is the want of *animal food*, which they get in summer in abundance in the form of *insects*. The reason they stop laying and go to setting, after laying a brood of eggs, is the continual excitement of the animal passions by the males. I have for several winters reduced my theory to practice, and proved its entire correctness. It must be observed, that the presence of the male is *not* necessary for the production of eggs, as they are formed whether the male be present or not. Of course such eggs will not produce chickens. When chickens are wanted, roosters must of course run with the hens. B.

From the Maine Cultivator.

GRAIN—PRACTICAL HINTS, &c.

Norridgewock, March 5, 1842.

Messrs. Editors—I am apprehensive that my communications will become tedious to many of your readers, on account of the minuteness of my details; but if those to whom they prove so, will reflect a moment, they will be convinced that writers on agriculture are apt to go into the opposite extreme, and only write on general principles or striking facts; taking it for granted that every one is already sufficiently acquainted with the minute details, which is far from being true. Few of your readers but can recollect some simple labor-saving observation, in your useful paper, which has been of more value to them than one year's subscription. With these convictions I shall continue to speak of things no otherwise important, than having convenience and saving of labor to recommend them.

I object to mixing grass seed with grain, to save labor in sowing, as much of it would be covered too deep by the harrow and treading of horses or oxen. After sowing my wheat or other grains they are harrowed twice—grass seed sowed, and then rolled smooth. On sandy loam, half a peck of clover and the same of timothy or herdsgrass, is a good quantity. In clayey loams two quarts of clover and eight of herdsgrass is about right—varying the proportions according to the soils—in very wet and bog-land soils, the clover should be omitted and a half bushel of red top and a peck of herdsgrass sowed to the acre. As a general

thing we sow too little grass seed. The consequence is, a poor tilth is left naked, and the growth on a rich one is so rank as to lose much of its value. Some use a brush harrow to smooth their ground and cover grass seed. This may do on ground too wet to admit the roller, but is liable to drag the seed and leave it uneven. I would always sow chaff in preference to clear seed; but it requires observation and judgment; for a bushel of chaff, which will contain two pounds of seed one year, may not afford half that quantity another.

Every farmer ought to grow his own seed; it is always a cash article, and if he buys he has to pay for cleansing, which is useless, unless it contains foul seed. If leached ashes are used on wheat, they should be spread before cultivating: If unleached, they may be sowed any time before the plants are four inches high. Were it not for pressing the earth around the seed, I should prefer not to roll my grain of any kind, till it was three or four inches high. It will then destroy myriads of insects, and cause the grain to branch more.

If this mode will not break the eggs of the Hessian fly, I know no means of doing it. All that has been said or written on sowing quick lime, ashes, or impregnating fields with the fumes of tobacco, sulphur, or *essences of pole-cat*, to destroy the fly, in July or any other month, has never destroyed enough of them to pay a man for a week's work. Some wise man in our state, has advised to *starve them out* of the country by ceasing to sow. I should not like to see it tried, as I fear the experimenters would starve first. Although women and children are not employed here as in Europe, to weed and glean grain fields, and field labor is expensive, still I am satisfied from personal observation, that many fields of wheat will well reward an outlay of one to three, or even four days expended in weeding an acre. By thorough weeding once, the Canada thistle may be prevented from going to seed before harvest. Every farmer should have a pair or more of weeding tongs. They may be made of wood, exactly in the shape of a pair of blacksmith's tongs,—the handle about four feet long, and spread so as to permit the operator to stand between them. Mine have the jaws and joint made of iron, with teeth on the inside, a turned hoe-handle screwed on each shank, like a goose neck hoe. I have also a sharp gouge, one and one fourth inch wide, handle four feet long: with these an immense number of weeds can be destroyed in a day.

The advantages of early cutting are so numerous that I must dwell a little on them. As soon as the upper part of the stock is turned yellow and the kernel is fairly in the *paste state*, put in the cradle the first fair day—I say the *cradle*, for before the grain is crippled by long standing, this useful instrument *can* be used. If you neglect to cut then, you may have rains, and winds to ripen, break down and shell out the grain—if rusty, the quality grows poorer—you must cut with a sickle—the straw is too brittle for bands—you can only handle it when the dew is on, &c.

Unless you feel able to purchase the little machine, with fingers pushed before a pair of little wheels, for taking up cradled grain, which is a great saver of time and back-ache, you may follow the cradle with a rake made as follows: head 2 ft. long, 1½ inch square, 6 teeth half inch in diameter, 10 inches clear of head--handle seven feet long—a dry fir is the right shape and light—on the back of head and handle, instead of bows, nail a triangular piece of half inch board, with which to even the butts of the grain. If your grain is good, you may stand in your place and gather a sheaf. Those who understand it, can make five bands sooner than I could describe the process. By the way, I know men who can make a band and bind a sheaf quicker than others can do the former. There is a *cleverness* in handling grain, which few men have arrived at in this section. I have had men in my employ who could not average half an acre in a day.

It is safest to stook the same day you cut. I prefer twenty bundles to a stook, on account of the power to stand against the wind. It is made as follows: Set up four pairs and one at each end: one pair and one, on each side of the centre;—place four cap-sheaves on each of these points, and fasten together in the usual way.

Cradled grain is much less liable to hurt in the stook or barn, than that which is reaped, on account of its looseness. Much grain is injured by mowing down too soon. In fact it would be better never to put it in close mows. I saw a grain barn at Guilford, owned by Hon. Joseph Kelsey, in which he had one scaffolding above another, so that the wheat all stood on the butts. It could not hurt in this way. I cannot doubt the flour would be much sweeter preserved in this way.

As to the mode of thrashing grain, it has come to be more expensive than before any horse power machine was in operation. It is my deliberate opinion that the man who has grain enough to make it an object to feed cattle on it, will save time and money by using the flail in preference to any machine; unless he can have one in his barn to use as he pleases. Few farmers will afford this. The time lost in tumbling straw out doors and pitching it back again, with the hazard of injury from stones are serious evils, all of which are avoided by thrashing and feeding from the floor.

Of barley and oats next time. Yours, &c.

JAMES BATES.

PROTECTION OF CORN AGAINST CROWS.

From the American Farmer.

Mr. O. M. Whipple, of Lowell, Mass., says, in his statement to the Agricultural Commissioner of Massachusetts, that for 15 years he has preserved his corn from the depredations of crows, by sowing on his field a quart of corn soaked in a strong solution of saltpetre. We can believe this, as no crow which might have eaten half a dozen grains of corn well saturated with saltpetre, would live long enough to bequeath his estate to his interesting progeny, though a scrivener were at hand, at the time of his making his meal, to draw his will. Saltpetre judiciously used, possesses medicinal virtues, but when taken in excess, is destructive of life, and hence the protection it affords to seed corn soaked in a solution of it, against worms as well as crows.

The best *scare-crows* we have ever used were bright sheets of *tin* suspended from poles, by wires; the poles of sufficient height, and in sufficient numbers, to be seen all over the field. Four

or six, if judiciously placed, will effectually answer for a field of 50 acres. Our mode of fixing them was this; we cut a pole of sufficient height, trimmed off all the limbs but the upper one; to the end of this limb, we attached, by a strong flexible wire, a sheet of tin, and planted the pole thus provided firmly in the ground on the distined spot. The limb left at the top, should project horizontally far enough to allow full play to the tin. Thus attached, the slightest breeze gives motion to the tin, and consequently causes a reflection, so sudden as to effectually frighten off crows, or other birds addicted to picking up the corn. Three years successful use of such *scare-crows*, justify us in recommending them to our brethren.

From the Kentucky Farmer.

FORCING FRUIT TREES TO BEAR.

Greenup Co., Ky., March 3, 1842.

Dear sir—Having addressed you an epistle a fortnight ago, I did not at that time intend to write you again until I saw your comments upon the project proposed in that letter, but being under the conviction that I could not write too much for the good honest-hearted yeomanry of the land, provided I keep in the limits of valuable information, I have, by the idea of facilitating the labor of the producing man in some measure, been prompted to address you at this time, the main object of which is to apprise the agricultural community of a novel mode of raising apples. I do not wish to be understood that it is novel with all, for it has been practised in Europe for many years, by the farmers in Germany in particular, who probably are the inventors; but I mean that it is novel to me, and if not to all, in my knowledge is at least not practised by them. The steps to be taken by the farmer to force his fruit tree to bear, as it is termed, are of a very simple nature and can necessarily be executed by any person who turns his hand to it without the aid of a practical operator, further than a description of the process. I hope, therefore, that my agricultural friends will not deem the description which I am about to give of the process to force trees to bear unnecessarily minute. With a sharp knife (the blade of a penknife is the best) make a cut in the bark of the branch which is meant to be forced to bear, and not more than eight or nine inches from the place where it is connected with the stem, or if it is a small branch or shoot, near where it is joined to the large bough, (three inches or less,) the cut is to go round the branch, or to encircle it, and penetrate to the wood. Care must be taken not to cut the wood, which would necessarily cause detriment to the branch or shoot operated upon. A quarter of an inch or nearly from the first cut make a second in the same way round the branch or shoot, so that both encircling the branch or shoot, a ring is formed thereon a quarter of an inch broad between the two cuts. The bark between these two cuts is now taken clean away with the small blade of a penknife, down to the wood, removing even the fine inner bark, which immediately lies upon the wood, so that no connexion whatever remains between the two parts of the bark, but the bare and naked wood appears white and smooth; but this bark ring, to compel the tree to bear, must be made at the time when the buds are strongly swelling, just before breaking out into blossom. In the same year of this operation a callus is formed at the edges of the ring on both sides, and the connexion of the bark that had been interrupted is restored again without any detriment to the tree or branch operated upon, in which the artificial wound soon again grows over. By this simple (though artificial) means of forcing every fruit tree with a certainty to bear, the most important advantage will be obtained by those who watch the time nature is ripe for it. Three years ago (the time when I was first informed of this singular way of forcing trees to bear,) I made an experiment on an apple tree. Being somewhat cautious of humbuggery I confined the experiment to one branch of the tree, which was about a fourth part of the whole top of it. I did not notice it until May. I had partially forgotten it, as I had but little faith in its having any effect toward making the tree bear, and called by rather to see if the limb which I had cut was not dead than to observe any thing else; but to my astonishment I found the limb which I had expected to find dead in a vigorous state of life, with as much young fruit on it, apparently, as all the rest of the tree. On examining the young fruit, I found that on the branch which I had cut to be sound and firm, while that on the other parts of the tree were dwindled and very much decreased. I expected at first that it was owing to the cut which I had made on the branch, but I satisfied myself by examining other trees which I found to be in the same way, and which I found shortly afterwards to be falling off. In September, when I gathered the apples, I found that the branch of the tree which I had made the experiment on, had five bushels on it, and the rest of the tree had not above one bushel on it, and that was inferior fruit. I would therefore recommend that farmers who have orchards would try the experiment. It would be well for them to be particular in the operation at first for fear of damaging the tree.

WILLIAM R. THOMPSON.

AN ESSAY ON THE BEST SYSTEM OF ROTATION OF CROPS, (HOGS,) PORK BEING THE CHIEF SURPLUS OF THE FARM.

From the Kentucky Farmer.

The first rotation on a pork farm is corn, rye fed down to hogs, clover (seed sown on rye) two years. This rotation will improve the ground very fast.

In consequence of the probable injury that would be likely to be done to the corn crop by the worms, when following clover, that crop should be broken up in the fall or winter season, the sod being turned over in the fall of the second year the frost of winter will effectually destroy the cut worms.

The advantages of this rotation will be to furnish a succession of food suitable for the hogs, at the same time enriching the soil.

Without a proper supply of corn the raising of pork would be a poor business in Kentucky; and a proper supply of corn cannot be easily raised

except upon fertile land; and the fertility of the land cannot be kept up without making a proper return to the soil for the corn taken off. All this will be done by this rotation.

The corn in this rotation is the only exhausting crop. This exhaustion is more than supplied by the fertilizing properties of the rye and the clover. All that is produced of both rye and clover is returned to the ground, except so much as is retained by the hogs to make flesh and fat, and this waste is more than replaced by supplies drawn from the atmosphere.

The corn supplies food to finish fattening, and a part of this may be fed in the field where it grew, thus adding to the fertility of the soil. Where the corn is thus fed, rye may be sown in the field a few days before the hogs are taken out; and they in gathering corn will put the rye well into the ground. But I prefer ploughing it in, after the hogs are taken out of the field.

If the ground should break up cloddy the roller and the harrow should be both used; but if there should not be many clods the harrow alone will be sufficient to level the field. The importance of a level surface will be seen when the ground is in clover, and when it comes to be ploughed the next time.

The rye will afford the hogs early spring grazing and push them forward very fast with the addition of a little corn. This early spring grazing is very beneficial to hogs, besides being a great saving of more costly food. The rye will keep them until one of the clover fields is ready to receive them, which may be about the 20th of April. After they are put into the clover, if the weather should be cold, so that there will probably be frost, it would be well to take the hogs out of the clover field, and keep them out, until the frost is off the next morning. Frost does not hurt clover that is not disturbed at this time of year; but every branch and leaf that is touched whilst the frost is on it, dies down to the place where it was injured. In this way I once had ten acres of clover nearly destroyed one morning, by one hundred hogs passing through and feeding on it, whilst frozen. My other clover lots were not at all injured by the frost as they had no stock upon them that morning.

The clover will afford the hogs good grazing until the rye is ready for them, which will be about the first of July. When the hogs are first put into the rye, some should be cut and got out and put in the paths which are made by the hogs, that the young ones may learn to eat it, which they do not always learn readily, unless they are put in the way of knowing what it is.

Now when the hogs are taken off; one of the clover fields may be saved for seed. The rye will last the hogs, (if there is enough of it,) until corn is sufficiently advanced to commence feeding them with the new crop. And this is one of the excellencies of rye, that it will keep in the field longer than any of your small grains. If there should not be enough rye, the hogs will go into the clover fields again, and now, they would pay well for having a little corn thrown to them every day.

The clover seed should be sown upon the rye about the 10th of April. A bushel should be put upon ten acres and as evenly distributed as possible. A box ten or twelve feet long, made of very light materials and having divisions every foot, with holes in each division, sows clover seed more evenly than it can well be done by hand. After the field has been once set in clover, the seed should be allowed to ripen the fall it is intended to plough it up; which will furnish a sufficiency of seed to keep up the rotation without sowing again. If seed in the chaff is used there should be a bushel per acre.

In this rotation two bushels of rye should be put to the acre. This quantity will supply more grazing than would be had from less seed, and will also afford a better crop, by supplying enough to make up for the roots that may be killed by the hogs rooting them out of the ground. Hogs root in grazing rye much less than would be expected.

Then the rotation upon the hog farm will be corn, rye, each one year; clover two years.

But even on this farm I shall recommend another rotation. The family will want flour, and wheat cannot be raised in a rotation with rye without considerable mixture with the rye. Then here the rotation should be wheat, corn, wheat, clover ploughed in the second year for wheat again. Upon these fields the manure from the stables may be hauled the year it is in corn, and the ashes and chip manure the year it is in clover. The spent ashes is a most excellent top dressing to clover. Or the spent ashes may be used as a top-dressing for the wheat crop, or applied to the growing corn crop.

When the fertility of the soil is sufficiently advanced; two crops of corn, two crops of rye and two years in clover, may be the rotation. And in very rich land the rotation for several years together may be corn and rye alone.

From many years trial of this rotation of corn and rye, I cannot perceive that the soil has been at all injured in its productiveness. I have raised a crop of corn which was cut up in the usual way, and the field sowed in rye, which was eat down with hogs. This affords a large coat of straw to be ploughed under, and keeps the ground in a loose, mellow, rich condition. Moreover the corn crop in this rotation is easily worked.

Oats may be substituted for the rye in some of the fields in this rotation. The large Tartary or Poland oat when fed down to hogs leaves as much straw on the ground as rye. Oats bring hogs forward faster than rye, and afford more grain to the acre: these are advantages in favor of the oat. But the oat does not stand up as well as the rye, is soon injured when it falls, sprouts the first rain after it is on the ground and must therefore be fed off very shortly after it is ripe. If oats are raised in considerable quantities for hogs it would be best to cut and get out a large portion of the crop for them, and only allow the hogs to go into one of the fields that was not too large for them to eat up before it would spoil. Even where rye was the principal small grain raised, it would be advantageous to have one field of oats of such a size that it might be consumed when ripe without waste. Where oats has been raised, rye will grow well the next year, if the oats are ploughed under and allowed to come up before the rye is sowed. If the rye is sown on the top of the ground and ploughed under with the oats the first time of ploughing, so many of the oats will come up as to partially smother the rye and do it much injury.

In my trials clover has not succeeded well when sown with the large Poland oat, in consequence of the oat growing so thick as to smother the clover.

Barley from its productiveness and its agreeing well with hogs might be occasionally sown in one of the fields in place of rye.*

Hogs make much manure where they are fattened, and (if they are not fattened in a field) their manure should be hauled out to be applied to the corn crop.

It will be perceived that I have not included the very popular root crops in my rotation upon a farm where pork is the surplus; and I give the following reasons for rejecting them. They are too uncertain.

The turnip is the most uncertain of all our crops. So uncertain, that a good crop cannot be raised more than one year in four. The beet, carrot and parsnip have generally been tolerably certain crops, until last season, when the whole of them were destroyed by the blister fly and the grass-hopper. Even if they were certain they require too much labor at a season when it cannot be spared from the corn crop. Irish potatoes, though free from the last objection, is not from the first. The whole crops were destroyed by the blister fly, (cantharis vitata,) last year.

The only root that I would recommend for its productiveness, profit and certainty upon the pork farm, is the artichoke (helianthus tuberosum,) which is easily raised and very much relished by hogs. The apple orchard is a proper place for planting them. The hogs that are not intended for market may be kept upon them most of the winter; they afford abundance of food and the rooting of the hogs in the fall and winter would destroy many of those insects that are so injurious to an apple orchard.

In parts of the country where mast is plenty the artichoke would be very valuable to be used those years that the mast fails. Should the artichokes not be needed they receive no injury from being left in the ground, as they will continue to grow and increase, and may be saved until from the failure of the mast they may be wanted.

SAMUEL D. MARTIN.

THE FARM AND FARMING OF THE REV. J. H. TURNER—NO II.

For the Farmers' Register.

In a former communication, when treating of a sound economy, that most indispensable appendage to good management, in the hurry of writing, I omitted an illustration which I will now supply. I intended to state, that I keep no overseer. I once had one, but he, though a very honest and respectable man, gave me more trouble than all the negroes put together. I constantly had to do the very things which I paid him to do. It is a very rare thing that the hired man has any eyes except for his own interest. Accordingly, I had to see every thing, and tell the overseer about it, and direct him to do it; and this gave me more trouble than to do it myself.

These overseers, besides, are generally very expensive things. In addition to their wages, their families, if they have any, must be supported. An extra horse must be furnished for the man to ride, and an extra cook for the lady, and an extra cow for the family; and when these, together with the multitude of other nameless *extras*, are taken into the account, the aggregate becomes very formidable in the catalogue of expenses. Accordingly, it is no uncommon thing for the overseer to become rich much faster than the employer. Indeed I have several times known him to acquire a handsome fortune, when the employer lost one. On large estates, it may be necessary in some instances to have an overseer, but in ordinary cases, I do think it would be better to repose the necessary confidence in a faithful servant, and thus invest him with the authority and responsibility of a head man. On small farms there is no doubt on this subject.

Connected with this, I will, with the risk of "bringing an old house over my head," say, that the farmers' *wife* ought in ordinary cases to dispense with her housekeeper. Whilst her husband is his own manager in his proper department, she ought to make her influence felt in all the departments of her proper sphere. Instead therefore of paying another woman to carry her keys, to lock and unlock the meat house, to visit the kitchen or dairy, or to superintend the poultry establishment, she ought to do these things herself. Nor let any active healthy woman (and these are the very women for farmers' wives) feel that in undertaking these things she will encumber herself with over much serving. It is true that these duties, if faithfully performed, will make it necessary for her to stay pretty much at home; but then industry, connected with early rising, and especially a *tact* for business, will make the whole comparatively easy.

I once knew a woman who had a remarkably kind and affectionate husband, but he was an easy "good for nothing" sort of a creature—would sit in the house all day, kiss his wife and caress his children, but would do almost nothing in the way of business. This good man's affairs, as may be supposed, regularly became more and more disordered. His estate, which was at first an ample one, got into ruin, and a heavy debt added greatly to their difficulties. In this state of things, this good man, but bad manager, died. The affectionate widow was almost overwhelmed with sorrow. Here she was left with an estate in disorder, with a family dependent upon her for a support, and with a large debt for which she had to provide, and all this in the very midst of affliction and bad health. At length, when her grief had exhausted itself, she rallied her energies, and showed what she really was. A combination of circumstances now called her true character into action. She mounted her horse, and rode over her farm; the broken down fences

* Last year I sowed a small piece of millet, which produced at the rate of 60 bushels to the acre. I tried some hogs that were in a pen, and they readily ate the heads of it. If this article should succeed equal to my expectations, it will be a valuable article in our rotations upon the hog farm, taking the place of the rye and producing more than double the acreable product. Some, left in the field for the purpose, was found to stand up well and retain its seed in a sound state the whole summer and fall. It produced not only more grain but more straw than any of the small grains that we are using for hogs, and has the advantage that it can be gathered by hogs with less labor than any other grain that we raise for them.

were repaired, order was called out of confusion, and with the aid of a head man alone, the estate was, in a few years, completely relieved from its oppressive debt. This good lady, though now far advanced in life, enjoys better health and spirits than she did in her more youthful days, and all is to be ascribed to her enterprise and industry. Should these remarks meet the eye of this good old lady, I hope she will excuse them. I submit them, not to render her conspicuous, but simply to show what industry and good management, even in a delicate female, can effect.

As another matter of economy, I will mention, that in the various appendages and fixtures of my farm I made it a point, that whatever I got should be of the very best order, and that without regard to the original cost. As an instance of this, I will state, that the cheapest cow I ever owned, cost me when delivered $95. And in purchasing my fine hogs some time ago, I got some as low as $30, but among them, there was one for which I paid at least $120, and this is decidedly my cheapest hog.

And here I will take the liberty to remark, that farmers very often commit a capital blunder in this important thing. They often suppose that the cheapest things are those which cost the least money; whereas the cheapest are those which yield the greatest profit on the amount expended, and at the same time contribute most to our convenience and gratification. Perhaps there is no instance in which this mistake is more frequently and strikingly displayed than in the purchase of land. In this important matter, farmers seem often to lose the faculty of looking ahead, and fix their eye only on the present expenditure. The essential points, fertility, facilities for improvement, and convenience to a good and steady market, together with other things which make land really valuable, are all lost sight of, or are all merged in the sole consideration of a cheap purchase. A little good land in the neighborhood of a good market is worth more, in my opinion, than all the lands of the moon and of the seven stars put together.

My predecessor, as I have been informed, lived on my present farm as long as he could. My old friend, John Carter, has several times told me that his last crop of corn consisted of stalks not larger than his fingers, and he verily believes that it did not yield a peck to the acre. And as I have had occasion several times to make public mention of this gentleman, I will tell the reader who and what he is. Mr. Carter is a plain man, without education, and has sense enough to make no pretensions to it; is a man of close, constant and accurate observation, always experimenting, and would certainly long since have ruined himself, but that he deals in this dangerous article in a small way. In this way he has stored his mind with an exhaustless variety of facts, which his great kindness prompts him to communicate for the information of all. His sole fault is, that he is too prone to draw general conclusions from particular cases. But to return from this digression. My predecessor being thus starved out here, followed the great multitude to the west, where I doubt not he found better land, but I do doubt if he found more substantial means of improving his condition.

This land being thus abandoned, remained for a long time (a small part excepted) in what is called the old field state. Some of it, it is true, had strength enough to put up a sweetbrier, a persimmon, a young pine, or a cedar bush; but large portions of it were so destitute of cover, that the straggling cattle, in their wanderings, merely passed over it, without stopping to take more than a bite or two. In the mean time, I was busily looking out in the neighborhood of Richmond for a small farm, with the view of making it my own. I saw many, but for reasons which it is not necessary to detail, I could not or did not obtain them. At length my eye rested on this forlorn spot. It was in market, and notwithstanding the almost hopelessness of its aspect, I resolved on a purchase. In the midst of the many discouragements with which it was surrounded, there were however some redeeming circumstances, which went a great way towards reconciling me to it. Its position, for instance, was in that direction from the city in which improvement was making the most rapid progress. It was situated on a good and level road, so that access to it would at all times be easy. Its surface was neither so hilly as to subject it to washing, nor so level as to retain large quantities of stagnant waters. Besides, when I came to examine the land itself, it was not so desperate as its first appearance indicated. It is true that a considerable portion was low, lying along both sides of three branches which passed through it, nearly the whole of which was a cold, tenacious pipe clay. But the remainder, which was far the greater proportion, was a light silicious soil, firmly imbedded on a strong red clay foundation.

These then are the materials on which I commenced my operations. In the details, I have perhaps been too particular, but I thought it necessary to be thus minute, that the reader might have a distinct view of the whole subject. And now the absorbing question with me was, how I could most speedily, and at the same time economically, bring these desolate lands into a state of profitable cultivation. To plant or sow them in their present state was a folly of which even a tyro would not be guilty. In this emergency, I had almost no assistance except my own reflections, aided by the little experience I had acquired in my very early youth. At that time (15 years ago) Liebig had not written his 'Organic Chemistry,' in which he sets forth the great value of ammonia. I had never even heard or thought of humus, nor guano, nor poudrette, nor urate, nor bone dust, nor any other of the "*multum in parvo*" manures of which the books treat at the present day. If the editor's invaluable 'Essay on Calcareous Manures' was then in existence, I had not seen it. But in the midst of my want of information as to other and better means of improving lands, I was satisfied of the great and certain efficacy of rich putrescent manures. This was then my resource, and I availed myself of it with all the means in my power. In the beginning, as might naturally be supposed, I made many mistakes in the use of this article. For instance, I used it in the drill, when I ought to have applied it broadcast, and I immediately covered it with the plough, whereas I am now convinced that I ought to have left it on the surface. But amidst my blunders, I conceived the idea of making all the manure I could at home, and then

of adding to it all in my power from town; and this I am sure was no mistake.

The reader is now in possession of the chief material by which I have brought my farm to its present fertility. The quantity used at first was about 50 cart loads of 25 bushels each to the acre. This materially improved the land, as the crops clearly indicated. But I could plainly perceive that there was an evident falling off in the second, and especially in the third and fourth crops. This made a second manuring necessary; and I am now convinced, that excessively poor lands, such as mine were, cannot be made permanently rich under *three* distinct manurings. These several applications ought to follow one another at intervals of about three years. I find that land managed in this way will regularly furnish a crop every year, and at the end of nine years, have so much fertility as greatly to aid itself, by the rich luxuriant vegetation with which it is clothed. Subsequent cropping will make additional manuring necessary, but then half the original quantity will be sufficient. Our small farms, brought to this fertility, and regularly treated in this manner, will furnish a crop, according to the season, *every year*, and so far from deteriorating, will constantly improve; and this I call the "*ne plus ultra*" of good farming.

But there is another article, which I have used to a considerable extent, and with most decided advantage in enriching my farm; and that is the coal ashes. It was observation, and observation alone, which induced me at first to resort to this substance for the above purpose. I had never seen nor heard of its being used for any other object than that of stopping a ravine or of making a foot path to cross the muddy streets of a city. But I had remarked the Jamestown weed and other rich vegetation growing in the most luxuriant manner, around the edges of heaps of this article deposited in gullies and other very poor places. Doctor Tazewell, also, from whom I made my first purchase, in sending for wood from his lot, had been in the habit of carrying out coal ashes and depositing them on the poor places. There also I had the most striking evidence of their fertilizing properties; for all around the edges of these little mounds the green-sward had formed a strong and close turf. With this evidence before my eyes, I could not resist the conviction, that this despised and neglected thing was a valuable manure. It also occurred to me, that my white livery lands were the very place to apply it. Accordingly after grubbing and otherwise preparing these low places, in which I had a deal of labor, I began to cart on the coal ashes. And here it is ludicrous to tell what a subject of ridicule I speedily became among my sapient neighbors. My carts were sometimes stopped, and the question seriously asked, "Can your master be in his senses, in carrying out that useless thing?" I however persevered, and the very next season I reaped as luxuriant a crop of grass, from this poor cold livery land, as I ever saw grow on the rich bottoms in the upper country. The tables are now completely turned, for I frequently detect my neighbors in committing the same folly, for which they heaped on me such a load of ridicule.

There is also another circumstance which highly recommends the coal ashes as a manure, and that is, that they are not only speedy, but *permanent* in their effects. How long they will last, and still manifest their efficacy, I cannot tell. I can point to places on my farm which were enriched by them ten years ago, and these places are rich still. Every time I plough I bring up portions of these ashes, and they appear as fresh as they were when first applied. Whether they have the faculty of fixing other manures in the soil, I cannot tell; but this I know, that they have the wonderful faculty of fixing themselves. From the fact of their exceedingly slow decomposition, one would suppose that they had but little, if any, efficacy. But when I see those places on which they have been deposited, closely covered with a strong turf, I must conclude that there is a powerful influence at work, though I cannot understand the mode of its operation.

Encouraged by my success on the cold livery lands, I determined to test the value of this article on the higher and lighter lands. And here the experiment was equally satisfactory. On a part of a field which I cultivated in corn I applied putrescent manures; on another part, lying along the side of it, I applied coal ashes. The season, especially the latter part of it, was rather a bad one for corn. About the time of earing, it was attacked with a drought, from which the crop suffered severely. But I could but notice the striking difference in the two portions of the field. Where the manure was applied the blades fired, and the product was indifferent; whereas, where the ashes was put, the corn maintained a vigorous green even to the lowest blade, and the crop was a heavy one.

But the chief value of this article is as a top-dressing on the grasses. Here its uniform action is as a charm. Last spring I had the pleasure of a visit from a highly valued friend from the upper country. This visit, as he said, was to the farm as well as to me. After passing over several fields, I conducted him to one which had been covered with ashes the preceding winter. And here he expressed his utter astonishment, declaring that he had never seen any thing to equal it, except under the strong influence of gypsum. I ought to observe, that this field had been seeded to timothy and herds-grass, but there was a considerable sprinkling of volunteer clover among it.

There is, however, one great drawback to the value of this article, and that is its great weight. When sobbed by the rains of winter, (and most of it is in this condition,) 12 bushels is a good load for an ordinary team. Indeed my mules often suffer very much under their task of three loads per day to the distance of about three miles. Upon the whole, I am so thoroughly convinced of the enriching qualities of coal ashes, that could I find a bed of them on my farm, I should feel myself amply compensated for the want of the richest marl.

But the editor has thought proper to read me a short homily on my neglect of lime. On this I have a word or two to say. And, first, I thank him for his remarks. I receive them in the spirit of kindness, for this I know is the spirit in which they were made. But let us inquire wherein consists the great value of lime as a manure? And here perhaps I may advance some things which will deprive me of the good opinion which it seems that Dr. Dupuy and others have formed of

my mode of farming. If this be the case, I shall sincerely regret it, but shall, notwithstanding, proceed in my own simple but candid way.

No one, then, as far as I am informed, pretends that lime is an *enricher*, or that it has one single enriching quality. The early opinion was that it acted as a stimulus, strongly exciting a plant to seek for all the food that might be in its reach. But this opinion is now, I believe, pretty generally exploded; and the more modern phrase is, that it is chiefly useful in *fixing* the manures in the soil, and thus rendering them permanent. This, if I understand him aright, is the idea which the editor intends to convey in his note. Now in this I do most cordially and fully agree with him, and I do contend that my practice has been uniformly in accordance with the same. The editor, and all the advocates for lime, will admit that manure or vegetation of some kind is necessary as a *preparatory application*. No one, at the present day, will think of applying lime to a naked soil. But the first effort is to charge the soil with vegetation, and then the lime will have something to act upon. Now I have been doing this very thing ever since I became a farmer. My land, as I before stated, was perfectly naked. It would not do to resort to lime, whilst it was in that state. It needed manure, it needed a cover, it now has both; and now, and not till now, was it in a state to receive lime.

But it seems that manure will not be permanent unless it has been *fixed* by lime. This, I confess, I do not thoroughly understand. My idea is, that the manures fix themselves. The reason why they are not permanent, is because there is a deficiency in the supply. Make the supply ample, and I will guaranty that they will be permanent. In accordance with this, we see that in cases of great fertility the crop is uniformly a large one. Now let this crop fall and rot on the land, and thus keep up the necessary supply, and the consequence will be, that fertility will not only be permanent, but will actually increase. In forests, therefore, where the whole product is deposited, and nothing is taken off, the lands are in a state of continual progressive improvement, and that too without a particle of lime to fix the manure.

But it will be said that, according to this, the purposes of cultivation will be defeated; that the object of tillage is not merely to keep up fertility, but to obtain supplies for the other necessary purposes of life. This is all granted, and at the same time I maintain that, where the products are regularly removed from the land, depreciation will necessarily ensue, unless other vegetation is furnished to supply the deficiency. Lime alone, without other enriching substances for it to act upon, will not answer the purpose. "The one thing needful," then, is not lime, but enriching vegetation, to make fertility permanent. I will now inform the editor that, some time ago, I did use lime to some extent. My first experiment was with burnt oyster shells, and on a piece of land which had been recently cleared. Here the effects were evident and highly satisfactory. About this time I got hold of the editor's invaluable Essay on Calcareous Manures. Other shorter productions, also, setting forth the great value of lime as a manure, were constantly coming under my notice; from all which I concluded that this was indeed "the one thing needful" as an improver of the soil. A. Robinson, esq., my next neighbor, had also taken up the same opinion. Accordingly we both procured lime, and without regard to any previous preparation, made our applications with the most confident expectations of success. But mortifying to tell, our efforts were without any beneficial effect whatever. We had expended our money and labor, both to a considerable extent, and our only reward was mortification and disappointment.

In connexion with the above views, and going a great way towards confirming them, I will state that I lately made a visit to Mr. F. Staples, who is one of my most industrious and enterprising neighbors. I found him, just where I like to see every young and healthy farmer, in the midst of his negroes, not sitting on a stump, indulging his own indolence whilst taxing their exertions, but actually holding the handles of the plough and taking his full part in the labors of the day. Whilst there, besides several piles of manure which were deposited in his field at convenient points for his crop, I observed a considerable quantity of oyster shells, some already burnt, and others in a situation ready to undergo that necessary operation. I ought to inform the reader that, for two years or more, Mr. Staples has been in the habit of making considerable use of this article on his farm. And here I could not but be struck with the remarkable coincidence, that without any previous observation leading to the remark, this judicious manager, pointing to the lime did say, "I have been greatly disappointed in that article." Having been disappointed myself in the same manner, I was at no loss to explain the cause of his failure. It was simply because his land was not prepared for it. It needed the great prerequisite, *manure;* and all doses of lime administered in this state, instead of curing the patient, did but aggravate the malady. Here then is a distinction which I think of paramount importance, and I hereby give it all the prominence of which I am capable. By not attending to this distinction, I am fully convinced that much mischief has been done, and the only way to counteract the evil is to arrest it at once. How much my neighbors and others may have suffered in this way I cannot tell, but in my own case I am confident that $100 would not cover the loss. The editor, therefore, and all others who are so earnest about *fixing* manures with lime, will see to it, that the manures are in the land *before* they attempt to fix them.

But it will be objected, that according to my own account of the matter, one experiment in the use of lime was a successful one. To this I reply, that this only confirms the position taken above. It will be recollected that this experiment was on land newly cleared. Here there were many small roots and other litter for the lime to act on, without which, I hesitate not to say, there would have been the same disappointment as in the other cases.

And here perhaps I ought to conclude, but still I am unwilling to stop, fearing that I may not have been fully understood, and thus may draw upon myself the animadversions of others for sentiments which I do not entertain. I do therefore candidly state, that whilst I regard lime under some circumstances as a most valuable article, I do at the same time consider it a most

dangerous one, especially in the hands of the inexperienced. We now know that it is a most *caustic* thing, but we did not know it till we had first burnt our fingers with it. And as no one is disposed to blame himself, but if possible to fix it on others, we are disposed to give a portion of the blame to the editor, who, by representing it "as the one thing needful," has unintentionally induced some of us tyroes to inflict this injury on ourselves. In my next, (unless I have to defend myself from the attacks of others,) I shall detail my course of cropping.* J. H. TURNER.

THE FARM AND FARMING OF THE REV. J. H. TURNER—NO III.

For the Farmers' Register.

In the last number I promised to detail in this my course of cropping. But I must beg for quarters a little longer, whilst I take another slight excursion on my favorite pony, *economy*. And at the sight of the word *economy*, the reader will probably exclaim, "Monsieur Tonson come again!" But with the risk of this, I must say that a well regulated economy is one chief branch of agriculture, so much so that no treatise on the latter can be considered as any way complete, without an important bearing on the former.

I would then state, that in the several purchases of my land, negroes, stock and other things connected with the fixtures of the farm, I made it a rule to carry out the principles of Jack Randolph's "philosopher's stone—pay as you go." To this rule, I rigidly adhered, until I conceived the idea of building the house in which I now reside. Up to this time, I had boarded and lodged in town, but I spent every day at the farm. By this time, I had become so interested in the farm, in its improvements, crops, stock, &c., that to spend the whole day there did not satisfy me. I wished also to spend the night there, and to have my family with me. The air, the water, the scenery and the whole routine of employment were so much more congenial to my taste, than those of the town, that I longed to have my family at the farm, that we might fully enjoy our country employments. This made a house necessary. But here was the difficulty: I had by this time so exhausted my little fund, in purchases and various improvements, that I had almost none left for the proposed building. In this state of things, I had concluded to postpone the comfort of a house, until I could command the means to build one. But a kind friend, learning my wishes in this matter, generously offered to furnish the necessary funds. Build, said he, such a house as you choose, and draw on me for the cost, and pay me when convenient to yourself." Now here was a kind offer, which almost any one would have felt himself warranted in accepting. I *did* accept it, but in doing so, I involved myself in difficulty in several particulars.

Hitherto I had dug all my money from the ground, and every dollar came to me moistened with the sweat of my face. But now money came to me in large sums, and it came so very *easy*, that I was tempted to build a much larger and a much more expensive house than a plain farmer's family, such as mine was, had any need of. I invested therefore in a house a considerable sum, which it would have been far more to my interest to lay out in enriching my lands, and in other more profitable improvements. I now have a comfortable house, it is true, but I have it at the expense of a considerable unproductive capital, and this is by no means a comfortable reflection. In the mean time, after the bargain was concluded, and such progress made that it would not do to abandon the undertaking, my friend died, and I was left to make such other provision as I could.

Nor is this the only evil growing out of this mistake. I constantly felt myself fettered and hampered in all my operations. A debt to a considerable amount had been contracted, and during its pendency, I felt it my duty, (not to suspend payment as the banks have done, but) to suspend all the improvements, and indeed all other expenses, which were not absolutely necessary. But I record the fact with gratitude, that this harassing debt is now paid off, and that I "owe no man any thing but to love him." Hereafter it is my purpose to cling to Roanoke's philosopher's stone, with a tenacity which nothing but death can sever.

Perhaps I ought to apologize for this long and minute detail. I can truly say that, in making it, I have no selfish end in view. I hold myself up, in this prominent manner, as a beacon of warning to other farmers. Debt is at all times an exceedingly inconvenient thing. It is a very easy thing for one who has credit to *contract* a debt, but it is exceedingly difficult to *pay* it. A countryman some time ago in Richmond asked a citizen, who happened to be deeply involved at bank, and felt all the pain and inconvenience of his situation, "Sir, will you have the goodness to show me the way into the bank?" Pointing out the way with his finger, he replied "That is the way, sir; but I can tell you, friend, it is much easier to find the way *in* than to find the way *out*." This good citizen was an honest but unfortunate man, and as such spoke feelingly on the subject. I too can speak feelingly; for I can truly say, that in

* We shall be gratified if Mr. Turner will state particularly the mode and circumstances of his application of lime. We have entire confidence in all his statements of facts, and of course, in the want of any manifest operation, and of profitable success of the application. Still, such a result as total failure, or loss, if of judiciously conducted liming, is altogether opposed to general experience; and in the absence of all knowledge of the details of the experiments, we must suspect that there either existed some peculiar obstacles to the operation of the lime—or that benefit really was produced, but so late, that it could not be distinguished separately from the greater effects of the subsequent heavy and repeated applications of putrescent manures. We shall be glad also to learn Mr. Robinson's opinions as to what he may suppose was the cause of his failure, and whether there is any ground for our supposition expressed above. We will submit some comments on Mr. Turner's general opinion on liming; but not until his own views have been fully presented, and completed.—ED. F. R.

all the debts I ever contracted, I found money plenty and cheap; but when I undertook to pay them off, I found it scarce and difficult to obtain: *paying* a debt is always up-hill work; it is a hard row to weed, try it who will.

I will now go further and say that, as a general rule, no farmer ought ever to fetter himself with debt. No man has a right to make a slave of himself, and this every man does who contracts an unnecessary debt. Hence it is that the present is a time of peculiar distress. Go where I may, I meet with long faces, and hear complaints of hard times. And who is it that is in such distress? It is the debtor, and the debtor alone. Where there is no debt to weigh him down the farmer is in comfortable circumstances. His crops for several years in succession have been good, and the prices obtained remunerating. Merchants tell me, that such is the nature of their business that they cannot avoid debt. It may be so; but then they, in common with others, cannot avoid another thing, the thousand vexatious shifts and contrivances, called "*raising the wind*," to which they constantly resort to pay them off.

And now I hope that it will not be considered as an improper departure from my present undertaking, if I arraign and expose some of the intolerable evils under which we farmers are now laboring. And this I do not as a whig or democrat, but I do it over my own proper signature, as an oppressed and aggrieved tax-payer. If any responsibility be incurred, I hereby exonerate the editor and every body else, and take it upon myself alone. At the same time I believe there is independence enough in the press of the Farmers' Register, to incur every responsibility where the honor of Virginia is concerned. And here, without intending to flatter the editor, (I would not insult a high-minded man with a thing so fulsome,) I must say that Mr. Ruffin has received a very unworthy return for the valuable services he has rendered to his country. This then is the first charge that I make, that the farmers, yes, I am sorry to say, the *farmers* have not appreciated the services of the editor as they ought to have done. He saw and felt a great and sore evil inflicted upon the community by the banks, and he had the firmness and independence to arraign it; and because he made use of a farmer's work to tell the farmers their grievances, patronage, I am told, to a small amount, has been withdrawn from him. Now I am no apologist of the editor, nor have I his permission to say one word about his affairs; yet I must in justice to him say, that though he values not the loss of a few subscribers, yet he must feel the disgust and mortification which belong to every high-minded and independent man.* But I have other charges to make to which I proceed forthwith. My next charge then is that the banks have suspended the payment of *their* debts, when they will not allow me to suspend the payment of *mine*. I hold, for instance, a note of the bank, in which they promise to pay me a certain sum. I present it for payment. The reply is, perhaps in an insulting manner, "we have suspended and therefore do not pay our notes." Now suppose this same bank holds one of *my* notes, and on presentment, I tell them that *I* have suspended, not from whim, as in their case, (for they tell us all the time that they are *able* to pay,) but from actual *necessity*. Oh! say they, if that be the case, we shall soon try what stuff you are made of. The next thing is that formidable affair called a protest, the operation of which is to destroy my credit, and thus disgrace me. Nor does the thing end here, but if I have a horse or negro, or even a cow to give milk for my children to eat, the whole goes to pay the uttermost farthing.

I charge further that, in consequence of this suspension of payments, money, or rather bank notes, are made of unequal value, so that if I get a draft on a *paying* bank, I lose my *bread* in the operation.

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* Our much esteemed correspondent is not mistaken as to the fact of the injurious operation of bank influence, through its bought tools and slaves, on this publication; but he is greatly mistaken if he supposes that the amount of injury from that source, malignant as it may be, would alone be of much detriment. If *that alone* were all that opposed the success of the Farmers' Register, the editor might well disregard all effects of such influence of swindling banks and the fraudulent banking system of Virginia, as much as he despises all the hatred and malice of the individuals who are either so base or so duped as to be thus directed by bank rule and influence. The great and unceasing and all-important obstacle to the proper maintenance, and consequent full measure of utility of the Farmers' Register, is the general apathy and want of all public spirit, and *even of enlightened self-interest*, by the agricultural community of this state. The proportion of the agricultural class of Virginia is amazingly small, who participate in the generous feelings expressed above by one who merely feels and thinks as every member of that class should do, and would do, if true to their own and their country's best interests. The pecuniary support afforded to this publication has never been enough to compensate the editor for the risks and losses necessarily incurred; and for the last few years, there has not been enough of clear profit to pay for a capable clerk. Nearly half the actual support of subscribers is furnished from beyond the borders of Virginia—and the arrears of subscription now due, and of which the payment is desperate, amount to more than all the clear profit ever derived from the adventure. Under such circumstances, the work has been continued less in regard to any hope of its being properly sustained, than for other considerations. But with the close of this volume will end the editor's labors for ten of the best years of his life; and he will no longer obtrude, on the agricultural public, services which seem to be so little appreciated, and which have been so little aided by the sympathy of the great body of the members of the interest designed to be served. In the mean time, his own labors and efforts will not relax; and he trusts that the tenth and concluding volume (under his direction) of the Farmers' Register will be not less valuable than the best of its predecessors.—Ed. F. R.

I charge again, that the legislature, instead of correcting these oppressions, has aided and abetted the same by making it lawful for the banks to commit them, and that this thing has been in operation so long, that it now amounts to an intolerable grievance. But I shall be told, compel the banks to pay, and the brokers will get all the specie and carry it off. To this I reply—let the brokers get it and carry it off. It will even in that event be put no further out of my reach than it now is. As to all practical purposes, the specie might just as well be in Guinea, or in the moon, as in the Virginia banks. In either event, it is where we farmers can get none of it.

I charge, further, that the legislature is ruining us by their immoderately long and expensive sessions. The last legislature was in session a hundred and ten days; the present a still longer time. Now let it be borne in mind, that every day thus spent costs us tax payers, including all expenses, nearly or quite $1,000. We pay therefore, annually, for legislation, upwards of $100,000; and what do we get for it? It amounts to simply this. Our laws are regularly overhauled, some are made and then amended, but finding that they are worse than before, they are *un*-made and then made over again; and this making, unmaking, and re-making, together with a great many long speeches, consumes a vast deal of time and money. Indeed, *speeches* are nearly the only palpable thing that they do make; and how much the speeches are worth every man will judge for himself.

I charge that this legislature is extremely tender of all expenses except their own. As an illustration, I state that a number of poor clerks have been docked 10 per cent. in their salaries, whilst the legislators did not dock themselves one single copper. It is true that a solemn farce to this effect was acted by the present legislature. But what was the issue? I am mortified as a Virginian, when I am obliged to say, that a great majority in both houses, when brought up to their fodder, started back from the rack.

I charge that a great portion of the clamor and noise made by the legislature, about retrenching expenses, is nothing but a solemn mockery. Some time ago, they spent a whole week in trying to make a senator, and after squandering away so much time and money, they adjourned, and no senator was made. This session, they spent three whole days, and of course $3,000, in making a governor, but the state is still without its governor. At another time, they did make a judge, whose salary is $2,500, but it cost our economical legislature three whole days of hard speaking and voting, and the state $3,000 to effect it. Now, if the legislature did really wish to retrench expenses, why deal in such small fry? Why seize upon poor clerk's wages, and make them still poorer? Why not reach forth a strong hand, and throttle the monster at once! Why not adjourn at the expiration of thirty days or less, pocket their money with a clear conscience, and go home to their wives and children, and mind their own business?

I charge, lastly, that this same body has lost nearly every feature of that primitive simplicity which once so nobly characterized a Virginia legislature. The time *was* when the legislature had its pious chaplain, and those great men, John Marshall, and James Madison, and Patrick Henry, and every other member of that day, were not ashamed to be seen upon their knees, humbly asking wisdom from the GOD of wisdom. When I see men thus engaged I can easily believe that they are in earnest. They meet in legislative assembly, not to exhibit themselves—not to carry any party point, but to do the business of their constituents, and then go home.

Now as we can expect no reformation in the banks until the legislature compels it, no more can we expect any reformation in the legislature until the people arise in their majesty and demand it. It is for this purpose, that I, an aggrieved sufferer, have performed the painful task of writing the above. Located as I am, near the legislature and the banks, I see a great many evils which fall not under the observation of the more distant farmers. I have waited so long, that my patience is now exhausted, for a more competent person to take this matter in hand. As no one has come forward, I have reluctantly resolved to apply the trumpet of alarm to my own lips. I have condescended to no personalities, I have sought no man's disgrace, I have sought for reformation, and reformation I will have. It is probable that I shall not stop here; but through our agricultural societies and agricultural papers, shall continue to sound the alarm until there go up one universal shout—*reformation! reformation!*

At the beginning of this paper, I begged for quarters whilst I took a *short* excursion on my favorite pony, economy; but the jade has proved herself of much better wind and bottom than I had any idea of. She even ran away with me. I have now come fairly to the end of my course; whether with safe bones remains yet to be seen. And now for the matter in hand.

In my course of cropping I aim at no wheat nor tobacco. My farm is too small for the former, and the latter I consider too troublesome to be remunerating. In attempting these crops I should moreover meet with competition from all the farmers within fifty miles or more of my market. In determining on a main crop, therefore, it has been an object with me, to fix on that one in which I could most nearly enjoy a monopoly. And as hay is a bulky article, compared with its weight and price, so much so that it will not bear transportation to any considerable distance, I have made that my chief crop. All my farming operations are therefore subservient to the cultivation of the grass crop.

In looking back to the time when I commenced farming, I think it a little remarkable that, without any previous experience to guide me, I should fix on the very crop which, upon trial for fifteen years, I am still convinced was the very best for me to cultivate. I had observed that but little hay was brought to market from the neighborhood, and that most of that little was of very inferior quality. Mr. Porter and others, who were then in the habit of keeping large numbers of horses for the stage and other purposes, depended almost entirely upon the north for their supplies of hay. This was a matter of necessity with them, for the country supplied perhaps not one twentieth part of what was needed. Observing this, I concluded that if I could succeed in raising hay of a good quality, I should have no difficulty in finding a market for it. Nor in this

have I been disappointed. I have never in any instance failed in disposing of my whole crop, and generally at fair remunerating prices. Even at this time, when every body is complaining of the scarcity of money, hay commands a more ready and a better price than almost any other article.

Some of my neighbors have expressed to me the apprehension that the market would soon be overstocked with this article, and that therefore the price must go down. I entertain no such apprehension. The first effect arising from the increased quantity at home will be to arrest the importation from abroad. At present there is still coming a considerable quantity from the north. As long as this is the case, I have no fear that *good* hay will be a drug upon my hands. Indeed, I am pleased to see that vigorous efforts are now making greatly to increase this crop; and I hope the time is just at hand, when, in addition to our neighborhood supplies, we shall see large quantities borne to market on our canal and rail-road. It is quite time that Virginia should assert her own proper independence. She has been dependent long enough, and far too long, upon the north for her hay, and upon the west for her pork.

But the main point remains yet to be touched: what is the *value* of this crop? I answer, that I know no crop which upon the whole requires less labor, is more certain, and at the same time yields a fairer compensation. The chinch bug and Hessian fly, which prey upon our corn and wheat, never touch this crop; nor is it subject to the depredations of any other destructive insect. Give it rich land, well prepared, and a moderate degree of moisture, and this is all that it asks. If, therefore, it be subject to fewer casualties, and when produced commands a fair and ready market, I must pronounce it a good crop. But besides these recommendations, there is another, which in my opinion greatly enhances its value, and that is that I regard it as less exhausting than most of our other crops. I pretend not that this, in common with all other crops that are removed from the land, is not an exhauster; but then it ought to be recollected, that other crops, such as corn, wheat, oats, &c., when removed, make no effort to recruit themselves. They leave the land, with the exception of a little stubble, entirely naked. This is not the case with the grasses; for besides the stubble, they begin immediately to renew themselves, and continue doing so until arrested by severe frosts; so that the aftermath, especially in clover, is often equal to the first crop. This second crop falling, as it does, and rotting on the ground, must contribute materially towards repairing the exhaustion of the first crop. And this, in my opinion, is the true reason why grass exhausts less than other crops. In this view of the subject, I am greatly strengthened by Liebig, and other celebrated writers on the subject of agriculture. They say, and I think with much plausibility, that the very best manure for any particular species of vegetation is that which is derived from itself. Leaves, for instance, is the best manure for forest trees, and wheat straw for growing wheat. If this be the case, then the second grass crop, containing as it does the materials of the first, must be a valuable manure for itself; and this, I think, is a strong argument for banishing cattle and all other depredators from our fields. But more of this hereafter.

As to my mode of cultivating grass, and the peculiar grasses which I prefer, there appeared in the last (February) number of the Farmers' Register, an essay on grass culture, which, were it not that it contains signs of evident haste, I should be disposed to adopt as my own. Indeed I will refer to it, as unfolding pretty fully my views and preferences on the subject. I think it therefore unnecessary to add another word on this point.

But besides grass, which I regard as my main crop, I also cultivate corn and oats, and of late I have turned my attention considerably to the beet and turnip crops. All these, however, are principally for home consumption. If I have any surplus, that of course goes with the grass to market. There is one exception to the latter remark, and that is the corn. I never sell, *directly*, an ear of corn; for by it I support another crop, which, till better advised, I must think a profitable one: I mean my hog crop. And here, without entering into the minutia of detail, I will merely state, that according to the best estimate I can form, the matter stands thus—when corn sells at 60 cents the bushel, and pork at $6 the 100 lbs. (which I consider as a fair average for both,) by turning the former into the latter, I get 90 cents the bushel for my corn. Of course when corn is dearer, or pork is cheaper, my profits are proportionably less. But at the usual average price, I consider myself as getting 50 per cent. more for my corn. I ought also to state, that in arriving at this result, I have to be studiously attentive to other circumstances, such as a thrifty breed of hogs, the care that is taken of them, and the constant economy of their feeding. Now when any farmer can make up his mind to be *personally* attentive to these things, I hesitate not to say that he will find his hog crop yielding him a fair profit. It is true that the last season was a peculiarly discouraging one. I never knew pork so cheap, and the probability is that it will be many years before it is as cheap again. It is to be feared that many farmers who had engaged in raising pork will be induced to abandon it. This, let me tell them, is the direct mode to raise the article; so that when they are compelled to buy, they will have to pay heavily for it. For my own part, I am not at all discouraged. I have just effected the spring sale of my shoats and pigs, and the profit has been nearly or quite equal to any former occasion. For a fine young Berkshire boar, just eight months old, I received $55.

But I am again trespassing on the reader's patience. I must, however, before concluding, observe that my usual rotation (if I have any at all) is two consecutive years in corn, this followed with oats, and the three next years in grass. This of course takes up six years, and then commences the same routine again. I have no doubt that, at first sight, strong objections will be made to this course, especially as three grain crops are made immediately to succeed each other. But I beg the reader to suspend his condemnation, until I inform him that I have another rotation, and that is a rotation of *manuring*, and this I consider of more importance than any rotation of cropping whatever. On this hacknied subject of rotation I have a theory which is perhaps peculiar to myself, and which, when announced, will probably call forth the animadversions of some who are

wedded to their own favorite opinions. But fearless of this formidable consequence, I hereby inform the reader, that I shall still proceed in my own candid way, assuring him, that all I aim at is the *truth*. But as my paper is already a long one, and I have an increasingly strong objection to long communications as well as long speeches, I will defer till my next what I have further to say on this subject. J. H. TURNER.

ON GAYTING CLOVER.

From the London Farmers' Magazine.

Sir,—Properly securing the clover crop and other artificial grasses is a very important agricultural operation, particularly to those farmers who may reside in a humid climate. Observing what I consider very erroneous opinions abroad respecting the best method to be employed for its proper security, I would respectfully offer a few brief remarks on a short practice in this operation.

On leaving a clay land farm a few years ago, in an exposed and arid situation, where there was no difficulty in ordinarily favorable seasons in securing these crops in fair condition, and removing to a turnip soil, producing heavy crops of seeds, in a close situation and moist atmosphere, the seasons also being very wet and unfavorable, I had for the first three years a very great waste in this description of hay. The fourth year (1839) I had a beautiful crop of red clover, with a little rye-grass; and being again a very unfavorable season, I was determined to take every precaution to secure it without injury. I was advised to gayte or ruckle it (an operation which I will presently describe), as is sometimes practised by the best farmers in this neighborhood, and I believe in some parts of this riding of Yorkshire very generally. The work is performed chiefly by women, after the crop has been severed and laid a day or two to dry on the top: the operator beginning at that end of the swathe which was first cut, proceeds to roll it up by the hands till a sufficient sized sheaf is formed; then pulling from the top end a small band, which is tied round the top part of the sheaf so high as to admit the bottom part being spread out and firmly placed on the ground, in which direction it is left as perpendicular as may be, which concludes the operation. The gaytes should be placed in a straight line between the swathes, which gives it a neat appearance, a well as being placed on the driest ground. If possible, it is better done when the grass is dry on the top, but in precarious seasons I would not hesitate to put it together wet, as it will take far less harm in this way than being left on the ground. The mowers should lay the swathes as straight as possible, which greatly facilitates the operation.

The advantages attending this method are, first, it requires no more labor till it is fit to carry, except, perhaps, an occasional righting up, and at the time of carting a woman or boy to pitch it into heaps for loading, the rakers following; secondly, it effectually secures all the leaves and seeds, scarcely a particle being lost, as happens in wet seasons by repeatedly turning it; and thirdly, there is no season, however wet, in which it will not retain its quality; so much so, indeed, that in 1839 my seeds stood in gaytes for three weeks of almost incessant rain, yet they were at last secured so green and fine, it would have been difficult to say, when using them, they had been at all exposed. It is also the cheapest method, as a woman or strong lad will do an acre a day completely, even if the crop be large.

From the report of the Farmers' Magazine, the members of the Framlingham Farmers' Club will discuss this question again on the 24th May, and if any one of them will give this method only a partial trial, I think he will recommend it to his neighbors as worthy an extended practice, being the most economical, and securing both quality and quantity.

Should you deem these remarks worthy a place in the Farmers' Magazine, I should be obliged by their insertion. I am, Sir, your most obedient servant, ANTI-HAYCOCK.

Hall Garth Farm, Kildale, Jan. 26, 1842.

FURTHER CONTRIBUTIONS TO OUR RESOURCES IN MANURE. STERCORIZED BARK FOR NITROGEN AND PHOSPHATES.

From the Cornwall Royal Gazette.

Sir,—Independent of theoretical or chemical considerations, plain reasoning will indicate that the excrements of animals should return to the soil the refuse of their food; and consequently that as cattle dung is an excellent manure for grass, so night soil should be the most appropriate for corn. And the *fact* long known and acted upon by the Chinese and Belgians, is becoming more and more appreciated and employed in this country, though its value is yet imperfectly understood. It appears from Liebig, that the annual evacuations of one man (1½lb. per day liquid and solid—547lbs.) are sufficient manure for an acre of wheat, and that every pound of urine is equivalent to a pound of wheat, estimating the produce per acre at four quarters, (not too high for fair situations thus manured,) and the annual consumptions at one quarter per man (an over estimate): it results, that the excretions of one individual will supply manure for the consumption of four; so much of the nourishment of the corn is derived from the air. And hence some estimate may be formed of the great increase of produce to be obtained by due attention to the preservation of this article, now drained to waste in such profusion into rivers and the sea. And even in the modes of preserving and using it, by the aid of lime, much of its ammonia is wasted; and it has before been shown, that to the ammonia the corn owes its nitrogen, the element on which we have most to depend for improvement, both in quality and quantity. Lime should no more be mixed with night soil, than with gas liquor; on the contrary, the matters added to absorb the liquid, should have an acid tendency. Gypsum does very well by double decomposition. Peat earth is acidulous enough to fix the ammonia, where at hand; but in large towns, this earth often requires pretty distant carriage. Refuse bark is, however, generally produced in populous places, and is an incumbrance to the tanner, from which he is obliged to contrive various methods for relieving himself; amongst the rest burning, to the great annoyance and suffering of the neighborhood.

But tanners' refuse bark has also enough acidulous quality to fix the ammonia in night soils; and being so generally at hand in populous towns may be employed for the purpose extensively.

Three parts of tanners' bark to one of night-soil (urine included, which is as valuable as any part) will make a stronger manure than stable-dung; and with this further advantage, that the stable-dung requires to be rotted, to reduce the long straws, and kill the undigested seeds it contains; whilst the bark being already short, and the night-soil containing no seeds, it may be carted to the field at once; thus saving the heavy waste in rotting.

In the tan-yard, the bark may be stercorized, by having a privy or two, and suitable corners for the work-people, all made to drain upon the heap; calculating say 1 lb. of evacuations liquid and solid from each individual, per day. and proportioning the bark to it; what is above that quantity being disposed of to other persons, for the same purpose. All the hide wool and glue washings and house drainings should run into the same, which should be roofed over, to keep off the rain, but with open sides to encourage evaporation of the moisture. All the ashes of fires, whether of the works or house, should be added, to help the absorption, and destroy the smell; and by this means a tanner employing 25 hands may turn out 25×3 bark, and say $\times 2$ for ashes and drains; $25 \times 75 \times 50 =$ 150lbs. of manure per day, richer than stable dung, much better for corn, and losing nothing in rotting as not required.

In other places, as private gardens, school grounds, &c., the bark may be procured from the tanner, and added to the privy sink, in rather larger proportions, reckoning the evacuations at 1½lb. per entire day of 24 hours. Much less bark will do, say half as much as the night-soil, making up the quantity with garden mould; but the bark is so much additional vegetable matter, at little cost. It may be thrown in, a load at a time, for the excrement to fall upon; but the ashes should be added daily, so as to lie on the top, and absorb the smell. A long and large trunk should rise from the sink, to encourage evaporation and carry up also the smell still remaining; for although much subdued by ashes, it cannot be altogether destroyed without careful mixture not practicable for such a purpose. In this manner large quantities may be collected.

Peat earth will do instead of bark, as above stated, with the precaution not to throw it in in cohesive lumps, which will not absorb, but as dry and crumbly as practicable. The ashes are equally useful in either case.

J. PRIDEAUX.

From the Kentucky Farmer.

AN ESSAY ON THE IMPORTANCE AND PROPER MANNER OF REARING SHEEP, SUITED TO THE CONDITION OF KENTUCKY.

By Dr. Samuel D. Martin, Clarke county, Ky.

To prove the importance of the sheep, it is only necessary to state that all the men in the state are dressed in the productions of their wool half the year, and the preparation of this clothing gives employment to a large portion of the women several months every year. The amount of domestic manufactures in Clarke county alone, (which are principally of wool,) amount annually to $129,000. Beside their wool they furnish meat that is particularly wholesome and nutritious.

They are also very serviceable in clearing a farm of weeds and bushes, as they feed upon a greater variety of herbage than any other animal. Their manure is very valuable and is more evenly distributed by them over the ground they are fed upon than by any other stock, and has the advantage of having no seeds in it to fill the ground with noxious weeds.

It is believed there would be as great profits realized from sheep on our highest priced land as upon any other stock, and the land would be more rapidly brought into the highest possible state of fertility.

Upon such land I have found sheep to be subject to very few diseases, and very productive.

The males should be kept in separate lots until the middle of October, when one male should be admitted to every fifty females. This will bring the lambs from the middle of March to the first of April.

There should be ten acres of rye sowed for every hundred sheep, and the sheep should be turned upon this rye when their lambs are two or three weeks old, this will produce a plentiful supply of milk and enable the ewe to raise a strong and vigorous lamb. For want of something green for the ewes many lambs are lost. The lamb should be castrated at three or four weeks old, and it is also customary to shorten their tail to one or two inches.

At three months old the lambs should all be separated from the old sheep and kept in a lot by themselves. By weaning them at this age they learn to eat and become fat against the fall, and go through the next winter much better than those that are allowed to run all the season with their dams.

The grazing of the rye will also give the blue grass* a good start in the spring and upon this *good start* in the spring depends the value of the blue grass crop. A piece of blue grass that is allowed to show its seed stems before there is any stock turned upon it will produce twice as much pasturage as a like piece that has stock turned upon it as soon as they can get a little grass off it in the spring. The rye will last the sheep until the blue grass is ready to receive them, and after being upon the blue grass about a month they may be put upon the clover fields where they will find plentiful pasturage until the stubble fields are ready to receive them. These will afford them a plentiful supply of weeds and the different grasses for some time, when they may again be transferred to the clover fields. All this time we are keeping them as much off the blue grass pasture as possible. Now when the stubble fields and clover fields are exhausted the sheep should again be turned into one of the blue grass pastures, where they will find a great quantity of food collected for them which will last them through the winter.

Sheep are healthy and keep fat upon this blue

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* Green-sward, Poa-pratensis.—ED. F. R.

grass and will want no feeding during the winter, unless there should come a heavy snow upon which a crust should be formed. If that should be the case they should have a regular supply of hay, fodder or oats until the snow is sufficiently broken to get at the grass again. By having several such blue grass pastures and transferring the sheep from one to another their health will be promoted and an abundant supply of winter food be obtained. If sheep are turned early in the spring upon a luxuriant clover lot, especially in wet weather, they are liable to be hoven, which frequently proves fatal. On which account it is best not to turn them upon the clover before the first of June, and even then they should not be turned upon it when very hungry. After the first of June if proper care is taken when the sheep are put into the clover fields there is very little danger of its hurting them.

All that has been said in relation to sheep upon our best lands is applicable to the lands of an inferior quality, still we should have to vary our treatment in some particulars. A large portion of the soil of Kentucky that will not produce *fine blue grass* will produce abundant crops of timothy and clover. We should here have to make some greater provisions for wintering the sheep. Upon some such land orchard grass (Dactylis glomerata) succeeds well; and this will also afford a tolerable winter supply of food and a very early spring supply. But here we must depend principally upon clover and timothy hay, corn stock fodder, oats, and such roots and vegetables as we can raise.

Among the roots I would enumerate the turnip, parsnip, carrot, sugar beet, mangel wurtzel, Irish potato and artichoke.

The turnip is an excellent root from its productivenes and adaptation to winter feeding of sheep, but is too uncertain a crop to be depended upon in this state. The parsnip is a much more certain crop and the improved varieties are very productive and are easily kept through the winter requiring no care nor protection from the cold. The carrot is also easily cultivated and productive. Some of the varieties require to be protected in the winter, others do not. Sugar beet is a tolerable certain crop and easily cultivated, so is the mangel wurtzel; they both require protection and are easily injured by frost.

The Irish potato is so well known that I need say nothing more about it.

The artichoke (*Helicanthus tuberosum*) is the most productive of all the roots that ever I have cultivated; all the stock that I have tried is fond of them; they require no care, staying in the ground from year to year without injury, and are easily cultivated. I plant them in drills four feet apart and two feet asunder in the drills, and work them as I would corn, being careful not to plough deep the last time of ploughing.

Among the vegetables for winter feeding of sheep, pumpkins and cabbages are both excellent. The pumpkins may be stored away for early use in a cellar or root house or even in a fodder stack. And cabbage may be kept all the winter in a fodder stack, or even in a barn slightly covered with shucks or straw.

But it is principally on our inferior and mountain lands that sheep husbandry will be found peculiarly advantageous.

There are in the bounds of Kentucky many thousands of acres of land that can be purchased at prices from five to twenty cents an acre. Some of these mountain lands are rich and all of them calculated to afford abundant pasturage of the most appropriate kind for sheep.

To make this land available, one or two acres should be fenced in and the timber inside and for some little way out all killed, the sheep should be brought up and penned in this every night. By penning five hundred or a thousand sheep in this way in this pen for a month the land will be made very rich, and a week before they are taken out the pen should be sowed with grass seed. I should prefer mixing timothy, blue grass, orchard grass and red clover seed for this purpose. While the sheep are occupying the first pen another should be prepared for their reception the next month. In this way a pen of one or two acres will be prepared and sown in grass every month. Means should be prepared also for wintering these sheep. There are glades in most of our mountain land that have green grass in them all the winter; there is also a large quantity of winter fern, which, with oats, should be raised for the purpose, which will assist in wintering and keeping the sheep healthy. With the assistance of a good shepherd's dog, one man can easily herd and attend to two thousand sheep. These mountain lands are covered in the spring and summer with a profusion of pea vine, which will afford ample provision for the sheep; and when it fails, if the seed is put there they will be covered with clover and other grasses.

There are still a few wolves in the mountains, but they are scarce and easily killed in the following manner. Procure an old horse and kill him on some unfrequented ridge (wolves generally travel on the ridges) and stick holes in his flesh all over his body and put two or three grains of strychnine in each hole. The horse should be killed in the beginning of winter, as he will not decay during cold weather, and the wolves are also scarce of food during winter.

The pens that have been sowed with grass will produce a fine crop of hay for the second year, and this added to a crop of oats raised for the purpose will afford the sheep sufficient food for the second winter. The roots and vegetables mentioned before may also be brought into requisition here; and in good weather the sheep will receive much benefit from being driven every day to the glady valley or to those places where winter fern is abundant. The fencing and penning, and sowing of grass seed should be continued through the second year, and after the second winter those pens will afford sufficient hay to winter the sheep with very little assistance from other sources.

The greatest enemy the sheep have is the dog. I was pleased with a law of some of the eastern states upon this subject. They have a tax upon dogs; and whenever sheep are killed by them, the loss is repaired from this fund.

The shelter for sheep in those mountainous regions is generally very extensive. From Miller's creek in Estill county, as far up the river as I have ever travelled, which has probably been fifty miles higher, it would be difficult to find a place where there was not in two or three miles shelter for many thousand sheep under projecting rocks, and in large open-mouthed caves, such as sheep would readily enter.

Sheep should have a regular supply of salt at all times. Where hay is cut for sheep (or any other stock) it should be salted, as it is much more convenient to give them salt in the winter in this way.

The kind of sheep raised must depend upon circumstances. Where the chief demand is for mutton, some of the larger kinds of sheep may be most valuable, as the Bakewell or Cotswold. This will be especially the case where pasturage is very abundant, for these large sheep require pastures. But where the object is chiefly wool, the Merino or a cross of the Merino and Saxony will be found most profitable. The larger sheep will do better in our rich level lands than in mountainous regions. It might have been supposed that a cross of the Southdown upon our Merino flocks would be very advantageous. And such a cross has been strongly recommended in Kentucky.

But this has not been the result, in the trials that have been made in England. It is said in the Complete Grazier, page 230, that the produce of this cross had "tender constitutions, slow feeding, bad shape, and deficiency in the number of lambs. This new breed has therefore been generally given up in Sussex, and also in Wiltshire, where it has been extensively tried." The wool of the Southdown was considerably improved.

The following account of the different breeds of England is taken from Judge Beatty's Prize Essay upon the Agriculture of Kentucky, published in the 4th vol. Ky. Farmer, page 300:

"England is quite as celebrated for her breeds of sheep as of cattle. They may be divided into the long and short woolled kinds. Of the former, the most noted are the following, and they stand in point of size in the order named:

1, Teeswater wethers, weighing per qr. at 2 years old,		30 lbs.
2, Lincoln,	"	25
3, Dartmoor or Bampton,	"	25
4, Cotswold,	"	24
5, New Leicester,	"	22
6, Romney Marsh,	"	22

"These bear fleeces from eight to eleven pounds in the yolk. The Lincolns bear the heaviest. The Teeswater, Cotswold and Dartmoor wethers average nine pounds each, and the New Leicester and Romney Marsh eight pounds. These breeds all bear very coarse wool, which forty years ago sold in England at 10*d.* sterling (20 cents.) Of the short woolled kinds of native sheep, the most noted are the Ryelands and Southdowns. Southdown wethers average at 2 years old, 18 lbs. per quarter; the Ryelands only 14 lbs. at 3½ years old. They are a small race of sheep, but bear finer fleeces than any of the native sheep of England. The Southdowns are the next finest. Their wool at the period above-mentioned was worth two shillings and four pence, sterling, (56 cents,) and their fleeces average about three pounds.

"The Teeswater are the largest sheep in England, and are prevalent "in the rich, fine, fertile, enclosed land on the banks of the Tees, in Yorkshire." They are supposed to have sprung from the Lincolns, being an improvement of that stock, as regards size, with little alteration to the quality of the wool. They are said to be a breed calculated for warm, rich pastures, where they are kept in small lots, in small enclosures, and supported with food in severe winter seasons."

"The Lincolns of the improved breed are said to be "among the best, if not *actually* the best long woolled sheep in England." The flavor of the Lincoln mutton is superior to that of the Dishley, and is a great favorite at Smithfield. Their wool is from ten to eighteen inches long, but very coarse, being only fit for combing.

"The New Leicester or Dishley (Bakewell) is an improved breed of sheep, which, according to Mr. Culley, "is readily distinguished from the other long woolled sorts, by having fine lively eyes, clean heads, without horns, straight, broad, flat backs, round or barrel shaped bodies, fine small bones, thin pelts, and a disposition to make fat at an early age." Mr. Culley adds his testimony in favor of the "superiority in the fineness of the grain and flavor of the mutton, to that of the other sheep of the *long woolled kind.*" But upon this point other authors do not concur. The author of the 'Treatise upon Live Stock,' says the New Leicester mutton is the most fine *by grain* of all the large *long woolled* species, but of a flavor *bordering on the insipid.*" Mr. Livingston, in his admirable Essay on Sheep, speaking of Mr. Bakewell's improvement of the Dishley stock, says, he was of opinion "that fat upon the rump and ribs was more important than tallow, and accordingly he produced sheep on which it is *there found* five or six inches thick. He further remarks that "his sheep are, on that account, less valuable to the epicure than to the laborer, with whom they, in some sort, supply the place of pork."

The wool of this sheep is the shortest and finest of *combing wools*, the length of the staple being six or seven inches."

The late Mr. Robert Bakewell originated this improved variety, and it is supposed the base of the improvement was a cross between the Lincolns and Ryelands, the latter giving fineness to the wool and grain of the mutton. This breed is admitted "to be the most perfectly formed, and consequently more disposed to fatten quickly, and to contain a much larger proportion of meat on an equal weight of bone." They are said also to be more disposed to fatten than other breeds *of the same size of carcass;* but are alleged to be objectionable because of their "fattening too much, and the mutton, in consequence, becoming less delicate in its flavor than other breeds that require a greater length of time in the process.

The Cotswold variety are also of the fine species of combing wool, and, like the New Leicesters, are said to have derived this feature from a cross with the Ryelands.

The Romney Marshes are a large breed, carrying wool suitable for combing, of rather a fine quality. They acquire their name from the marsh on which they are chiefly raised, and are said to be well adapted to be "fattened on the rich kinds of marsh pasture, and on those which extend from Hastings to Rye in Kent." The author of the "Synopsis of Husbandry" says that "a convincing proof of the great value of this breed of sheep, as well as of the land on which they are fed, is that six to eight wethers may be fattened per acre." This breed

would be a valuable variety, for the flat and marshy lands which prevail in many parts of the north-western states, and which are found in some places on the borders of the Ohio and other rivers of Kentucky.

The Dartmoor or Bampton variety are prevalent in the districts from which they derive their name, the length of their wool is about the same as of the Romney Marsh sort. These breeds have been improved by a cross with the New Leicesters, which it is said "will in some situations bring forward wethers at 20 months old weighing twenty pounds the quarter, with a shear of eight pounds of yolk wool to the fleece." The mutton is said to be of good quality. It should be remarked that in England all the *large breeds of sheep* are raised chiefly *for the mutton*, and that wool is only a *secondary* object. The following statement will give a pretty correct idea of the usual price of mutton in England:

Mr. Dawson, of Buthorp, in the year 1796, sold two hundred *two shear* wethers, (two and a half years old,) at three pounds sterling round. An average of his sales for the six preceding years was as follows: 1790, 35*s.*; 1791, 35*s.*; 1792, 43*s.*; 1793, 38*s.*; 1794, 44*s.*; 1795, 50*s.* These were New Leicesters, which had been twice sheared. If each shearing produced eight pounds, (a large allowance for young sheep,) the wool at 10*d.* would have yielded 13*s.* 4*d.* or 6*s.* 8*d.* per annum. But the average of the sales of each wether during the seven years was 43*s.* 7*d.* Thus the amount received for mutton was six and a half times as much, *annually*, as was received for wool. It will be perceived that the price of mutton gradually rose from 35*s.* to 60*s.* At the latter rate, the *mutton* produced, *annually*, nine times as much as the annual produce of wool. The contrast between the wool and mutton, of the larger breeds, such as the Teeswater, Lincoln, Bampton and Cotswold, would be still more remarkable. It should also be recollected that since the year 1796, all kinds of meat have risen, whilst coarse wool has remained about stationary, and consequently that, at this time, the disparity between the price of wool and mutton would be still greater than it was in the year 1796.

I desire that these circumstances may be borne in mind, when I come to treat of fine woolled sheep and of the sheep husbandry of Kentucky.

Of the various native breeds of *fine woolled sheep* in England, I propose to speak only of the Southdowns and Ryelands. The latter were formerly held in high repute, in consequence of their extreme fineness of wool, but since the introduction of the Spanish Merinoes, (1792,) which far excel the Ryelands in fineness of staple, they have, in some measure, lost their former high reputation. They are, however, considered an excellent stock on which to cross the Merino breed. The half blood from this cross produce a fleece, it is said, averaging five pounds in the yolk, and worth 3*s.* sterling, (72 cents.)

The Southdowns are next to the Ryelands, as regards fineness of wool. Mr. Culley describes this variety "as having no horns, gray faces and legs, fine bones, long small necks, and rather low before, high on the shoulders, and light in the fore quarters, sides good, loin tolerably broad, back bone rather high, thigh full, twist good, mutton fine in grain and well flavored, wool short, very close and fine, in the length of the staple from two to three inches, weight per quarter of wethers, at two years old, eighteen pounds." This breed prevails "on the dry chalky downs in Sussex, as well as in the hills of Surry and Kent." It is said to have been "much improved, recently, both in carcass and wool, being much enlarged forward." They are considered as an excellent sort for less fertile and hilly pastures, as feeding close." They are "hardy, and disposed to fatten quickly." They come quickly to maturity, the wethers "being seldom kept longer than two years old, and often fed at eighteen months." They are also "capable of travelling well and of resisting the effects of exposure to cold." The celebrated Mr. Coke, now Lord Leicester, is said to have the best and finest Southdowns in England."

I have extracted the above from Judge Beatty, but as the author from whom he quotes spoke of the Southdowns of his day, I thought it proper to give the opinions of some later writers upon these sheep, and shall then proceed with my quotation. At present Mr. Ellman of Glynd is "said to have the finest Southdowns in England." The following extract is taken from Blacklock's Treatise on Sheep, written in England in 1838 and republished in the United States in 1841. On page 20, American edition, he says:

"*The Southdown*, like the Ryeland, are, from the delicacy of their constitution, unadapted for bleak situations, but sufficiently hardy and active for a low country; their average weight is from 15 lbs. to 18 lbs. a quarter; that of the fleece, which is very short and fine, being from 2½ lbs. to 3 lbs. They are without horns, have gray faces and legs, a neck low set and small, and a breast neither wide nor deep; their mutton is fine in the grain and of excellent flavor, having been brought to great perfection by Mr. Ellman of Glynd, and other intelligent breeders. They are mostly found in Sussex, on dry chalky downs producing short fine herbage, and arrive early at maturity; in which respect they are equal to the Cheviot, though inferior to them in quantity of tallow. Formerly they would not take on fat until four years old; now they are always at market when about 2 years of age, and many are killed before that period."

From the above quotation it appears that the Southdown sheep of the present day have "delicate constitutions" and are not calculated for "bleak situations," but are well suited for a low country. Neither Southdown, Bakewell or New Leicester, nor Cotswold would suit our mountain lands. The Merino, and their crosses upon our native sheep, would be found to suit our mountains best.

These Southdowns formerly were slow in coming to maturity, requiring four years; what means have been resorted to for producing their early maturity in the present race we are not informed. Whether it was the introduction of some foreign blood or judicious selection and breeding we know not.

It appears that, whatever the means may have been, the constitution has been so much injured that they are not *now* the same hardy sheep they were forty years ago.

A comparison of the mutton of the Southdown with the Merino, in the only case that has come to my knowledge, has resulted in favor of the Merino, and the Merino wool in England brings double the price of the Southdown. In the United States the difference in the price of the wool is not so great, the Merino being worth about forty or fifty per cent. most. The quantity of wool yielded by the Merino is also greater than the Southdown, whilst the quantity of mutton produced by the Southdown is greatest.

I have no practical experience of either Southdowns, New Leicester or Costwold, but believe the Merino, with their crosses upon our native sheep, will be found a hardier race than either of the foregoing, and whilst the relative prices continue any thing like they are at present, it will be much more profitable to invest money in them, than in either of the others.

I shall now resume my quotation from Judge Beatty.

An English writer, comparing the Southdowns and Norfolks (a very noted breed of the fine woolled sort) says "in short, the leading characteristics of the high and full bred Norfolk and Southdown sheep seem, upon comparison, to be chiefly these, the wool of both is found to be of the first clothing *quality*, but the larger *quantity* is produced by the Southdowns; the mutton of both is equally delicious. But the quiet, gentle Southdowns, in the pasture, must be opposed to the wild, impatient ramblings of the Norfolk, whose constant exercise not only excites continual appetite, but at the same time occasions a considerable waste in the pasture, by treading down and unnecessarily spoiling a great deal of food they do not eat."

It is further remarked, that "the hardiness of the Southdowns, enduring wet and cold lodging and a greater degree of abstinence and fatigue than the Norfolk, in the fold, is a superiority of much moment, and only to be equalled by another which they possess, in a very superior degree, which is that of doing well upon coarse and sour pastures." It is added "that the Southdowns, compared with the Norfolk, are equally good turnip sheep; and for every possible purpose, whether for their flesh, for their wool, for breeding, for folding or for the butcher, they demand a less supply of food and of an inferior quality to that which, in every situation, would appear indispensable to the well doing of the Norfolks."

The foregoing statements and facts present a very favorable view of the Southdown variety of sheep. But their merits are still more strongly sustained by a course of experiments, made by the Earl of Egremont to test the relative value of the New Leicester, Southdown, Romney Marsh, and some half bloods, being a cross of the New Leicester and Southdowns. It would occupy too much space to give the whole course of his experiments in detail, but the following is the substance of them. In the month of August he put in the same enclosure, wether lambs of the preceding spring, as follows: 17 Southdowns, 19 New Leicesters, 12 half bloods, a cross of the New Leicester and Southdown, and 7 Romney Marsh. They were all kept alike till June of the following year, when 12 of the Southdowns and all the half bloods were found in marketable condition; and the former were sold at 340, and the latter at 330, sterling. None of the New Leicesters or Romney Marshes were in marketable condition. This experiment shows the superiority of the Southdowns and half bloods, where it is desirable to sell at an early age.*

A part of each kind was kept over for further experiments, and it was found that between June and the 7th of September, (ten weeks,) the Southdowns had gained 13 per cent., the New Leicester 21 per cent., the half bloods 13 per cent., and the Romney Marshes 14 per cent. Here was a gain of 8 per cent. by the New Leicester, and 1 per cent. by the Romney Marshes, over the half bloods and Southdowns. This is naturally to be accounted for so far as relates to the Southdowns, from the circumstance of the two sorts, which had gained, being of a larger breed than the Southdowns. It will be recollected that the New Leicester wethers at two years old weigh 22 pounds to the quarter, the Romney Marshes 25, and the Southdowns only 18. They were now, (7th September,) about one and a half years old, and consequently it was to have been expected that the *larger breeds*, which had fallen back during the winter, should increase more rapidly during the summer, than the smaller ones, in order to attain their appropriate weight at two years old. They were weighed again the 1st of December following, when the Southdowns had lost 3 per cent., the new Leicesters 2 per cent., the half bloods 4 per cent., the Romney Marshes had gained one third of 1 per cent. All the sorts, it will be observed, must have continued to gain for some time after the 7th of September, and the larger breeds, for the reasons here stated, must have gained more rapidly than the smaller ones, till winter set in. At this period all would begin to lose, and the loss exhibited above *was not the whole loss*. What had been gained between the

* This experiment shows that the Southdown sheep bear starvation better than the New Leicester, but is not at all decisive of their earlier maturity under different treatment. Had the sheep been kept so as to prevent them from losing flesh in the winter and sold as soon as they were in condition in the spring, the result would probably have been very different.

We find during the time that they had plenty to eat, from June to September, that the New Leicester gained 21 per cent., while the Southdowns gained 13 per cent. Here it is likely the gain is much greater in the New Leicester than meets the eye. We are told that the New Leicesters are of a larger breed than the Southdowns, of course any per cent. upon a large animal, is much more than the same per cent. upon a small one. Blacklock gives the average weight of the New Leicester at 18 to 26 lbs. per quarter, and their wool at 6 to 8 per fleece. The Southdown is averaged by him from 15 to 18 lbs. per quarter, and their fleece from 2½ to 3 lbs. From the above it appears the New Leicester has 22 lbs. most mutton, and his wool at 20 cents, and the Southdowns 25 cents, which is about the market price of the two, the New Leicester fleece will be found to be worth about double the Southdown in Kentucky, where coarse wools bear relatively a higher price than fine.

For mutton I have no doubt that the Costwold and New Leicester, will both make a better cross with the Merino, than the Southdown: For wool I think neither of them should be used as a cross unless it be desirable to make coarser wool, when the cross with the New Leicester will be found to give double the quantity. S. D. M.

7th September and the period at which they began to fall off, should have been added. If these circumstances be taken into consideration, this experiment would be very favorable to the Southdowns; but the next experiment is still more decisive in their favor. They were weighed again the first of March following, when it was found the Southdowns had lost, between the 1st of December and 1st of March, four per cent., the New Leicesters 14 per cent., the half bloods 10 per cent., and the Romney Marshes 5 per cent. During the second as well as during the first winter, the Southdowns exhibited a decided advantage over the New Leicesters. The Romney Marshes, it will be seen, stand upon almost as good ground as the Southdown, and did much better than the New Leicesters.

The next experiment shows that from the 1st of Dec. to June 19th, the Southdowns gained 13 per cent., the New Leicesters 9 per cent., the half bloods, 9 per cent., and the Romney Marshes 17 per cent. Here again the advantage is decidedly in favor of the Southdowns and Romney Marshes.

The experiment was continued through the third summer, when, as might be expected, the New Leicesters again took the lead; and as the result of the whole experiment it is stated "that the profit for two years and two months feed, adding the value of the wool, was 5*d.* and a fraction per week for the Romney Marshes, and from 4*d.* to 7½*d.* for the New Leicesters, from the time of their being lambed. The former part of the experiment had shown that the Southdowns and half bloods, at the age of 64 weeks, gave 7*d.* per week profit."*

Thus it appears by a course of experiments fully and fairly made, by the Earl of Egremont, that the Southdowns, even for the purposes of mutton, are decidedly more profitable than the New Leicesters. And this result follows without allowing any thing for the *increased quantity of food* consumed by the New Leicesters, or for the *superiority* of the mutton of the Southdowns. It is a well established general principle, that the larger the animal the more food they will require. Here the Southdowns, the smaller animal, upon the same kind of keep, gave 7*d.* profit per week, at the age of 64 weeks, whilst the New Leicesters at the age of 113 weeks, gave a profit of only 4*d.* to 4½*d.* per week. The wool of the Southdowns is also more valuable. Those of a good quality will average three pounds, worth 2s. 6*d.*, (60 cts.) per pound, whilst the wool of the New Leicesters averaged, (ewes and wethers,) about seven pounds, is worth only 10*d.*, (20 cts.) The annual product of the wool of the Southdowns would be 180 cents, and of the New Leicesters only 140 cents.*

I have been induced to go into these details in relation to the merits of the New Leicester and Southdown sheep and of the Romney Marsh breed, in consequence of a strong impression having been made in this state that the New Leicesters would be the best stock for us to adopt with a view to mutton and common clothing wool. I am decidedly of opinion that for both purposes the Southdown breed of sheep would be greatly preferable. The mutton of the latter, in point of flavor, is greatly superior, the wool is every way better adapted to clothing purposes, the sheep are hardier, thrive better in winter, and would suit admirably the hilly regions, which predominate in the eastern, and south-eastern borders of Kentucky.† I am also of opinion that the Romney Marsh breed would be finely adapted to the flat and marshy lands which predominate in some of the new states and which are also found on the borders of some of our rivers.

"The New Leicesters will become valuable when we engage in manufacturing worsted, which will require combing wool, but in the mean time the best of our native breeds, improved by the introduction of the Southdown and Merinoes, will be better adapted to our circumstances and wants.

"I have hitherto only treated of the native sheep of Great Britain. It is wonderful that a people who paid so much attention to sheep husbandry and who were so extensively engaged in the manufacture of fine wool, should so long have totally neglected to introduce the Merino breed, confessedly the finest woolled sheep that existed any where in Europe. This was owing in part to their prejudices in favor of their own Ryelands and Southdowns and partly to an opinion that the Merinoes could not exist in the climate of England, or that if they could, they would so degenerate as to be less valuable than their own native sheep. It was imagined "Spain possessed some peculiar advantages of soil and climate which it would be in vain to look for elsewhere. And it was believed, says a British writer, "that the superior fineness of the Spanish fleeces was derived *entirely* from some peculiarity of the soil and climate." This opinion was so firmly fixed, says the same writer, "that he who asserted the contrary was regarded by agriculturists and clothiers as a speculative theorist, only deserving pity." Yet long anterior to the period when these *notions* were so strongly predominant in England, the Merino breeds had been introduced into Sweden. As early as 1739 "the Swe-

* This experiment would have looked a little more like it had been *fairly* made if the weights of the Southdowns had been given when they were sold, and the weights of the New Leicester the seventh of September when they were ready for market. But to keep animals that were fat in the fall of the year, and let them fall off in the winter and then compare their gain per week with those sold the summer before, looks like any thing but *fairness*.

If the sheep had been kept in growing order all the time, this experiment would no doubt have exhibited a very different result; and the question would not have been which kind would bear starvation best, but which would give most gain for feed consumed. There appears to be something unfair in taking for granted what is not proved, "that the larger the animal the more food they will require." It may be "a well established general principle," when applied to animals of the same family, but even then there will be found exceptions, but when applied to animals of different families, it should never be taken for granted, but should be proved before an argument can be based upon it.

S. D. M.

* These estimates are made in reference to the English market.

In the Kentucky market the New Leicester fleece would bring 60 cents most.

† See quotations from Blacklock, between pages 14 and 15. S. D. M.

dish government, for the promotion of this race, instituted a school of shepherds, under the care of Mr. Alstrœmer, (who first introduced the Merino sheep into Sweden in 1723,) and public funds were appointed for granting premiums to those who sold rams of this breed. These premiums were continued up to the year 1792, when being no longer necessary, they were discontinued.

Merinoes were introduced into Saxony as early as 1765, and they were attended to with such assiduity, skill and judgment, that the flocks of that country, in point of fineness of staple, soon came to excel the finest Spanish Merinoes.

"These examples did not escape the notice of France. In 1776, this celebrated breed of sheep was introduced into that country by Mr. Trandain, intendant of finances, under the direction of the celebrated naturalist, d'Aubenton. This experiment succeeded so well as to convince the government, "that it was easy to introduce and preserve a race of sheep in France, producing superfine wool; and in the year 1786, a selection of 376 rams and ewes, from the finest flocks in Spain, was made and were conducted under the care of a mayor, to the farm of Rambouillet." It was not until after all these experiments, that an effort was made to introduce these celebrated sheep into England. The first efforts were made by individuals in 1787, but the importation then made attracted but little attention, and scarcely excited any interest. "The sheep, however, (says an English writer,) *lived*, though treated in the English manner, and the wool *had not deteriorated*." These facts having proved that the Merino race of sheep could be naturalized in Great Britain, the then reigning monarch, Geo. III., in 1792 obtained from the Marquis of Campoalonjo, five rams and thirty-five ewes of the Nigrette race."

It might have been supposed, now that the sovereign of the country had taken a personal interest in introducing the Merino breed of sheep, that all prejudices against them would have subsided; but such was not the fact. "Although the wool was admitted to be equally fine, with the best wool imported from Spain," yet the manufacturers would not give the same price for it, "fearing that it might not prove equally good when manufactured;" and the king was compelled to have his wool manufactured on his own account, "to demonstrate its fitness for superfine cloth." So slow is the progress of truth in overthrowing *prejudice* and *error*. The merits of the Merino breed finally triumphed over all obstacles, and they are now deservedly held in Great Britain in the very highest repute, both as regards the pure breed and the crosses upon the best English stock. It has been ascertained that a cross of the *best* Merino rams upon the finest Ryeland ewes, requires *five* crosses to produce as fine wool from the mixed breed as from the pure stock. Thus a cross upon Ryeland ewes, bearing wool worth 3*s*. will produce a breed bearing wool worth 3*s*. 7*d*., and each subsequent cross will add 7*d*. to the value of the wool, so that after the *fifth* cross, the offspring will bear wool worth as much as the Spanish, that is, 6*s*. per pound, provided the *rams and ewes* are of the *finest quality* at the *commencement of the cross*. This shows the error of the opinion, that the new Leicester, or any other of the coarse long woolled sheep, will furnish a good cross for the Merino race. Next to the Ryelands, Southdown ewes of the finest quality furnish the best cross of any of the native sheep of Great Britain. The United States not having commenced manufacturing fine wool, at the period when the Merinoes were introduced into England, had not the same inducement to make an effort to naturalize that valuable race. But not long afterwards, Chancellor Livingston, our embassador at the court of France, studying to promote the interests of his country, by all the means in his power, turned his attention to this subject, and in the year 1802, selected "two pair of the finest Merinoes he could," from the improved flocks of France, "and sent them over under the care of one of his own servants, intending to follow them by others."* These, says Mr. Livingston, "were the first couples ever imported into the United States."

Shortly after this period, Col. Humphreys, of Connecticut, introduced directly from Spain, a considerable number of this valuable race. These importations laid the foundation of the Merino breed of sheep, which are now so numerous in the United States. They were first introduced into Kentucky by Mr. Seth Adams, in the year 1809. A small proportion only of his flock were of the full bloods, the balance being the produce of a cross upon the native sheep of the country. Shortly afterwards, Mr. Prentice, Mr. Lewis Sanders, and other spirited gentlemen, introduced a number of the pure blooded Merinoes. In the year 1829, the Hon. Henry Clay imported from the western part of Pennsylvania, a flock of fifty full bloods, being a selection from one of the best in Washington county. These and other importations have laid the foundation of the Merino flocks in Kentucky, and nothing is now wanting, but sufficient attention and skill, in the management of our sheep husbandry, to secure to us a full participation of the great advantages which must accrue to the United States from the rearing of fine woolled sheep."

"The political contests of the day and the selfish views of ambitious aspirants, may for a time depress the interests of agriculture and of *sheep husbandry in particular*, but it is impossible, that this can continue to be the case for any great length of time. When we look at our present population and take into consideration the well established fact, that it increases in a ratio of 33⅓ per cent. every ten years; that our exports except in a single article (cotton) instead of increasing in a ratio with our population, is continually diminishing, when we see the results of our present system, (depending upon foreigners to manufacture for us what we could so easily manufacture for ourselves) a system encouraged and promoted by the legislature of the national government; to the periodical reversions in trade of the most alarming and distressing character, arising in a great degree, from too extensive reliance upon foreigners to supply us with *clothing, blankets, and other necessaries*. * * * When we shall learn wisdom from experience, we shall be compelled (though perhaps not until after long and severe suffering) to do as all wise nations have done before us, protect our *agricultural interest*

* Livingston's Essay on Sheep, p. 9.

by giving protection *to those who manufacture the raw products of our agriculture.* When this period shall arrive, our Merino flocks, as well as those of other races will be found to be of immense value and of great importance to the general interests of the country. Wool to the amount of two hundred millions of pounds would be produced, (if due encouragement shall be afforded,) before our population shall have reached thirty millions, which will happen within the next twenty years, and in ten years thereafter it will probably have reached forty millions."* What vast results, then, are to spring from a proper attention to sheep husbandry! How immensely will the wealth and comfort of our citizens be promoted and the fertility of the soil increased by rearing and feeding 66,000,000 of sheep! But the direct advantages resulting from sheep husbandry will not be all. Other agricultural pursuits will be greatly promoted, first, by diverting a portion of agricultural industry from those branches which have been pushed to too great an excess; and secondly, by the new market that will be furnished for agricultural products, by the numerous class of individuals who will be employed in manufacturing the immense quantity of wool, which the United States are capable of growing. Too much attention cannot be given to this important subject. Fine wool, as well as that of a medium quality, (such as will be produced by Southdowns and a Merino cross upon that valuable stock,) and the product of our native stock will all be objects of much importance. And when the manufacture of worsted stuff goods shall be extensively introduced, combing wool will also be in great demand.

Sheep husbandry is important for three purposes, 1 wool; 2 mutton and tallow; 3 as a means of manuring and fertilizing our soil. I have sufficiently treated of the two first; the third is too important to be passed over in silence. I have heretofore suggested that much manure may be saved by folding sheep of nights. It is doubtful, however, whether the injury to the health of sheep will not be too serious to justify that practice, in warm weather; but in cool frosty weather folding sheep of nights may be safely resorted to. But whenever the practice of folding, for a length of time, in the same place, is pursued, the pen should be kept well littered with straw, [or leaves,] as well for the comfort of the sheep as with a view of increasing the quantity of manure.

It will be most convenient to have the sheep fold adjoining a shelter under which the racks and troughs are placed. The shelter should be entirely open on one side, with a south or south-eastern exposure, and enclosed on the opposite side; with a suitable building at each end, one for hay and the other for roots for winter and early spring feeding until the pastures are sufficiently advanced.* It would be most convenient to have the sheepfold and house adjoining a meadow, on which the sheep should be suffered to range during the day. This will be beneficial to the health of the sheep, and their manure will be saved, and distributed without the expense of hauling. With a view of the like saving of manure during the part of the year in which the sheep are not folded of nights, they should be suffered to range, as far as circumstances will admit, upon grounds intended for future cultivation.

In England it is a common practice to feed off their turnip crop to sheep, upon the ground upon which it grew. This is done by enclosing a small space with hurdles, into which the sheep are put and continued until they consume all the turnips growing within the enclosure; another space is then enclosed and fed off and so on in succession until all are consumed. This is found to be a very convenient practice in England, as it saves labor, both in feeding and distributing the manure, and might be adopted here with great advantage, if, upon experiment, it shall be found that the ruta baga† will succeed well in our soil and climate and is sufficiently hardy to stand our winters.

A species of cabbage, that is sufficiently hardy to stand the winter in England, is frequently fed off to sheep, upon the ground upon which it grew, in the same manner as turnips, and it would be worthy of inquiry and experiment whether cabbages suitable to our climate and soil could not be raised to advantage for feeding sheep, during the short period we cannot furnish them with grass or while the grass is covered with snow.

It is probable that the sugar beet will be found to be a more valuable crop in our dry soils than any description of turnips.‡

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*" The Albany Cultivator estimates the number of sheep in the wool growing states of the north at 15,000,000."

This estimate I consider greatly too low. The single county of Washington, Pennsylvania, has 1,000,000.

The balance of this note is a table showing the increase of our population from 1790 to be 33 1-3 per cent. for every ten years. This table I deem it unnecessary now to copy. The census that has been taken since our author wrote proves the correctness of his calculation.

The population of the United States is now 17,068,180.

The population of Kentucky is 776,923. S. D. M.

* If the blue grass pastures have been permitted to grow the latter part of the season, they will afford green food all the winter, and upon this and pasture of green rye, the sheep will do better and be more healthy than fed in any other way. These pastures are good all the winter. The sheep should be turned off them the 1st of March to give them an opportunity of producing a good crop of grass. The rye fields, will now support them until the 25th of April, when they can be turned again upon the blue grass pastures. M.

† The ruta baga succeeds but poorly upon my farm. I have raised many crops, and although I have drilled them very early as well as late, and worked them well, I have never raised a crop that were at all to compare with the accounts I have seen of this root.

I thought for a few years that the fault might be in my seed, and procured seed from a great variety of seed stores, yet the result was the same. The ruta baga grows mostly above ground, and will not stand our winters without protection. We have a large turnip that grows mostly under ground that will stand our winters well. Early sown in May has done best with the ruta baga.

‡ The sugar beet is much more productive than the ruta baga, and until last year was a very certain crop. Mine were injured the season before last, but were entirely destroyed last year by a dark-striped blistering fly (Cantharis vitata) generally called the potato fly. Those flies or rather bugs destroyed my potatoes, carrots, parsnips, beets, and cabbage. If these bugs should

The latter are so subject to be destroyed by insects when they first come up ; and are so liable to be injured by drought, as to render them too uncertain to be relied upon as a crop for winter food for stock. The beet crop is much less subject to injury from insects, and will probably be found more productive.

One of the great recommendations of sheep husbandry is that it can be carried on extensively with less labor than any other branch of farming producing the same profits. If blue grass pastures are saved for them, and the quantity of rye before recommended be sown, they will not require feeding more than ten days upon an average in a year, and this feeding may be done with oats, hay, or corn-stalk fodder. Where there is a deficiency of blue grass, other means must be resorted to for the purpose of supplying them with winter food. Rye holds a place with me next to blue grass ; but it is not expected that rye will produce food for a large flock of sheep all winter. I would then recommend that oats, clover hay, timothy hay, and hay from any other grass that the farm will produce be provided in sufficient quantity to winter them, and after this raise as many roots as you can.

In the mountainous regions where caves are plenty the best place to keep those roots that require protection is in one of those caves. Roots will not freeze thirty yards from the entrance of any of those caves unless the mouth is very wide and high ; and if that should be the case put them in a little farther.

Roots keep well buried in the ground, about fifty bushels in a place. They should be laid on the surface and piled up as high as they can be, and have leaves or straw put over them, and be covered by throwing on a foot of earth. A stick two inches in diameter should be stuck in the top of the pile and after the dirt is put on, tread the dirt around the stick, and pull it out, and have a little bundle of straw large enough to fill the hole, and put it in it. The straw or leaves will prevent the roots from getting dirty, but they will keep equally as well without. In England rape is very much used for the purpose of feeding sheep and enriching the land. It supplies a rich and very fattening food for sheep the latter part of summer and in the fall. It is particularly serviceable in fattening those that are for sale, and preparing those that are kept, for passing better through the winter. An acre of good rape will last one hundred sheep ten days. Experiments should be made for the purpose of ascertaining whether rape be suitable for our soil and climate. If it should succeed with us, it would be particularly valuable in enabling us to save our blue grass pastures for winter use. It is generally sown on the poorest ground, which it speedily enriches. But it will grow better upon rich ground. A few acres are fenced off for them at a time.

The climate of Kentucky is particularly congenial to sheep. When they can have green food all winter, they are subject to scarcely any disease. When confined and fed upon dry food they are not so healthy, and great loss of lambs is sustained by those who have nothing green for their sheep during the suckling season. Sheep bear confinement worse than any other of our domestic animals.

Although I have said above that where blue grass pastures can be obtained that sheep will not require more than ten days feed during the winter, yet I would recommend that provision be provided for feeding them two months. Each sheep will eat about two pounds of hay a day.

I would recommend that the hay for the sheep be stacked in the meadow where it was cut in the following manner. Plant a smooth pole from 6 to 10 inches in diameter firmly in the ground, and around this make your stack of hay, beginning small and swelling very much to the middle and then tapering again to the top. As before observed salt should be sprinkled on whilst building the stack. When the ground is covered with snow so that the sheep cannot get grass, they should be turned into the meadow which should also have water in it. A spring should be included in the meadow, if possible, as it would afford them a constant supply of water, without breaking the ice, which accumulates so fast upon our ponds and streams, that although it may be broken three times a day, still, in extreme cold weather, the stock will suffer for want of water. I would recommend that shelters be formed in the meadow in the following way. Build a fence by placing each rail upon the other at right angles, so as to form pens thus :

these pens should be covered with cornstalks fodder, straw or whatever is most convenient. On the back part they should have cornstalk fodder stacked against them, which should be protected from the sheep by a fence run around, if the shelter is not made in a division fence, which will generally be most convenient. The fodder stacked against the back of the pens may be fed away to other stock late in the spring when it will be no longer needed at the pens. The pens that are not open to the sheep (for it will be perceived upon this plan they will have access to only half the pens) may be also covered and will serve to keep pumpkins and cabbage covered with straw for the winter use of the sheep.

It will be perceived that I recommend temporary shelters instead of permanent ones. For which I give the following reasons: My system contemplates a rotation of crops, and this meadow will in a few years be cultivated in other crops ; and another meadow with another set of temporary shelters be brought into requisition. The manure that accumulates about the pens will be easily spread over the meadow, or over the adjoining corn-fields. The straw used for covering the pumpkins and cabbage may be thrown into the pens for a litter as they are fed away. But above all, this plan will prevent the sheep from being crowded in large numbers in one pen, which is sure to injure their health. Clover makes the best hay for sheep, but it re-

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continue as abundant as they were the last season they will cause the sugar beet to be a very uncertain or laborious crop to raise.

I killed them off mine three times, and each time my beets began again to put out leaves and grow, but they came again in such numbers as to cause me utterly to despair of exterminating them. M.

quires more care in stacking out than other hay. Clover stacks should be topped off with straw or timothy or blue grass hay in the following way. As soon as the stack is built up to the middle, straw or some other hay should be placed all round the outside as you proceed in building, for a foot from the outside, and all the centre filled with clover hay; this should be continued until the last course, which should be entirely of straw or some other hay. A stack built in this way will present on the outside, from the middle up, the appearance of being composed of straw or other hay, and will turn the rains off the stack. Clover hay will permit the rains to run through it, unless thus protected. Clover also suits better in a proper rotation upon a farm than most other grasses, yielding a large crop of hay the year after the ground has been in small grain, and enriching the ground very fast. This subject properly belongs to the treatise upon the best rotation of crops; so for the present I will say no more upon the subject.

As the selection of males is an important matter in the rearing of sheep and the chief instrument whereby the flock is to be improved, I will give the following description of a good ram, taken from Culley's Treatise on Live Stock: "His head should be fine and small; nostrils wide and expanded; eyes prominent and rather bold and daring; ears thin; his collar full from his breast and shoulders, but tapering all the way to where the neck and head join, which should be very fine and graceful, being perfectly free from any coarse leather hanging down;* the shoulders broad and full, which must at the same time join so easy to the collar forward and chine backward, as to leave not the least hollow in either place; the mutton upon his arm or foreleg must come quite to the knee; his legs upright, with a clean fine bone, being equally clear from superfluous skin and coarse hairy wool, from the knee downwards; the breast broad and well forward, which will keep his forelegs at a proper wideness; his girth, or chest, full and deep, and instead of a hollow behind the shoulders, that part by some called the forelock should be quite full; the back and loins broad, flat, and straight, from which the ribs must rise with a fine circular arch; his belly straight; the quarters long and full, with the mutton quite down to the hough, which should neither stand in nor out; his twist (i. e., the junction on the inside the thigh) deep, wide, and full, which, with the broad breast, will keep his forelegs open and upright; the whole body covered with a thin pelt, and that with a fine, bright and soft wool."

Besides the above characteristics, it is of the utmost importance that the wool be of the quality desired. And he should be pure blooded of his kind.

In the mountainous regions, if large flocks should be kept, the shepherd should be almost constantly with the sheep. In enclosed lands a very effectual guard against dogs is two or three cows with young calves, in the same lot with the sheep. If a dog comes into such a pasture, the sheep will run to the cows, and they will be ready to fight for their calves, and will immediately chase the dogs out of the enclosure. I have lost no sheep with dogs when I have kept them with cows and their young calves.

There is at least four millions of acres of mountain lands within the boundary of Kentucky, and it would be a very moderate calculation to say that those mountains would support one sheep to the acre now, and as they become improved, two or more would find support there. Four millions of sheep would require a population to attend to them of forty thousand persons, supposing that every man, woman and child could attend to one hundred each, and would afford an income of one hundred dollars for each member of the family, calculating the wool at one dollar per fleece, beside the increase of the flock.

It would require 30,000 persons to manufacture this wool (if done by hand) into coarse cloth, and a much larger number to make fine cloth.

Thus those mountains would easily be made to sustain four millions of sheep, which would give wages of $100 each to seventy thousand inhabitants.

In Spain and some other countries the wool is washed after the sheep have been shorn. In England, Ireland, Silesia, Saxony, and in the northern parts of the United States the wool is washed upon the sheep, The following is Baron Shultz's account of the Swedish manner:

"Before shearing, the wool is almost universally washed upon the sheep. Some persons wash the sheep in the open sea, or in running water, but this is never so clean as when the sheep are first washed in a large tub, with one part clear lie, two parts lukewarm water, with a small quantity of urine; and then in another tub, with less lie in the water; after which the sheep are washed, laying them always on their backs, with their heads up, in a tub of clean water; and lastly there is poured on the sheep standing on the ground a sufficient quantity of water, which is as much as possible squeezed out of the wool." After the sheep are washed they are driven into a clean green pasture, where they remain until they are dry."

In Silesia the method usually practised simply consists in making the sheep crop a running stream after obliging them to plunge in, from a pretty high bridge.

In Saxony they are made to cross a brook or river; the next morning they are again made to cross the river, in which they are dipped that the fleece may be uniformly penetrated; after which they are stroked or pressed down with the hands, beginning at the head and proceeding thence to their extremities.

After the sheep are dry they are sheared, and the "improved method consists in cutting circularly round the body of the animal, the beauty of which is, in consequence of this, believed to be increased, while the work is more uniformly and closely executed. The shearer holds the sheep under him, either with his knee or left arm, and clips the wool with spring shears, which he can manage with one hand, and thus performs the operation without assistance, unless the sheep are unusually strong and restive. The entire fleece is stripped at once and rolled up together, and the

* The Merino sheep have much loose skin hanging down under their necks and throats. This is a characteristic mark of the breed, yet much may be done to get rid of this leather by selecting those rams that have the least of it.

qualities are afterwards assorted by the wool stapler." Before the shearing is commenced the sheep should have all the coarse and *kempy* wool from the hips, legs, pate and forehead sheared off and kept apart from the other wool. Further, great care should be taken in shearing not to give the wool a second cut, as it materially injures and wastes the wool.

During the whole process of shearing care should be taken that the sheep be not injured by clipping the skin.

The fleece should then be laid on the side that was next the sheep, the sides and belly part turned in, and beginning behind should be carefully rolled to the shoulders, when the wool of the forepart should be rolled back to meet the roll from behind, and should be secured by tying it with twine.

Sheep of the long woolled tribes have been shorn twice in the season, but the experiments have not been attended with any advantage. And short woolled sheep of the Merino breed (which breed does not shed their wool) have been allowed to wear their fleeces several years. Experiments of this kind were made at the French national farm of Rambouillet, from 1804 to 1814, which proved that fleeces worn from three to five years were superior in staple and produced a larger sum than those that were annually shorn. This was also the case in an experiment lately made by Lord Western, whose Merino wether with a fleece of three years' growth produced thirty-two pounds of wool twelve inches long and of beautiful and fine quality.

Lord Western proposed to show a Merino wether against any other breed, on condition that size should not pass for merit; and Mr. Hicks took it up, and produced a Southdown wether supposed to weight 160 lbs., and the judge decided in favor of the Merino.

The butcher (Mr. Barwell, of Witham) who purchased the Merino, says, (in a letter to Lord Western,) "the carcass of this sheep, inside and out, was as good as I ever had; and in point of color the Merinoes carry generally a brighter red and white than any other breed.*

A writer in the western Farmer and Gardener over the signature of "Umbra," who writes like a man of sense and observation, (but whose opinions and observations are not entitled to as much weight as if his name had been given,) says that the cross of the Southdown with the Merino and with the Leicesters have each proved failures.†

A letter from Mr. Twyman, an English gentleman, says, that he has completely succeeded in combining the good qualities of the Southdown and Leicester, the wool being as long as the latter but much finer and closer like the former. One hundred which were shorn at thirteen and a half months old, produced, on an average, nine and a half pounds of wool each. The sheep were sold directly after being sheared at three guineas each, and two shillings per lb. was refused for the wool.

The importation of wool into England in 1827, (the only year that I have the entire amount,) amounted to 29,122,447 lbs. Since that time the amount imported has increased very much.

England, that is not twice as large as Kentucky, produced in the year 1800, 77,964,760 lbs. of wool, and in 1828, 92,280,480 lbs.*

What England has done Kentucky *can do.*

S. D. Martin.

* Farmer's Cabinet, Vol. 5, page 377, taken from English Farmer's Magazine.

† Page 261, Vol. 2.

FARMING AT WESTOVER.

By the Editor.

In the latter part of March, in company with two very young farmers, I visited Mr. John A. Selden, of Westover, and passed the greater part of the day in walking over that highly improved and beautifully cultivated farm, and conversing with its proprietor. Such a visit, to any one who has either agricultural taste or pursuits, cannot fail to bring both pleasure and profitable instruction. Something of what we saw, and what was said, principally by Mr. Selden in answer to inquiries, will be here stated.

Notwithstanding its great amount of annual product, Westover is quite a small farm, compared to the lands of most cultivators in eastern Virginia, even in middling circumstances. The original tract gives but four fields of 100 acres each; and the farm proper now is no larger.—There is some back land since purchased, and as yet unimproved, kept for wood and pasture; and also 100 acres of arable land on the river, still more lately bought, and then generally poor, and which is yet but partly improved, and has as yet added but little to the general product of the farm.

* The number of sheep in the United Kingdom of Great Britain in 1828, was 44,100,000. Supposing that each of these sheep produced one dollar's worth of wool, it would be about $75 each for every *white* man, woman and child in Kentucky, giving to every one in cities their shares. There was exported from England in 1828, $29,898,505 worth of the single article of spun and wove woollen goods, besides many articles in which it formed a constituent part; for instance hats to the amount of $159,485.

In 1839, Australia produced 20,128,774 lbs. of wool, where 22 years before there had been produced in that country only 345 lbs. 100 years ago in Ireland there were 1,500,000 persons engaged in manufacturing wool, and their wages amounted annually to about $58,687,000. About 1830 the number of persons engaged in the manufacture of wool in England was 480,000 to 500,000 and their average wages were from $96, to $100 each. The value of the raw material was about $30,000,000, and the manufactured articles $90,000,000. In 1835 there was imported from England into the United States, $13,000,000 worth of woollen goods. If this had been *made at home* it would have given employment to 130,000 persons at wages of $100 each.

About 1770 machinery which enabled (in 1800) one man to do as much work as had been done by three before, was first introduced.

For further information upon sheep, permit me to refer to the society's* treatise upon sheep and Blacklock's treatise written in England in 1838, and just published in the United States in 1841.

* The (English) Society for the Diffusion of Useful Knowledge. S. D. M.

The addition of this 100 acres permitted Mr. Selden to plan the adding a fifth field and crop, to his before well known four-field rotation. But subsequent circumstances required him to abandon or postpone the intention of that change, before it was commenced; and now, as before, his rotation is the four-field, of three grain crops and one of clover, which has become so celebrated by its successful practice at Curles' Neck, Shirley, and Westover, and which has been so ably advocated by the published opinions and arguments, as well as the successful practice, of Mr. Hill Carter and Mr. Selden. The latter seems to have returned from his meditated partial abandonment, to his "old love" of the four-shift rotation, with even increased ardor and confidence. And though I have heretofore objected to this rotation, as too scourging, and as contrary to the sound principles of rotation (in the three consecutive grain crops,) and though still holding to these opinions, as to lands in general; still it must be admitted, if the question is to be judged of by practical results, that it is scarcely possible to imagine a better rotation for combining profit and improvement, than Mr. Selden's, on his good land, and with his good management. The rotation (as has often been stated in this publication) is 1st, wheat on clover fallow; 2d, corn; 3d, wheat (and oats,) with clover sown, and 4th clover, to be turned in by a deep and well executed ploughing in August and September, then to recommence the course with wheat again. The designed alteration was to introduce a green manure crop of broad-cast field (or Indian) peas the year after corn, to be turned in for wheat; making the rotation, 1st, wheat, 2d corn, 3d, peas, 4th, wheat, and 5th, clover. And this, on lighter or fouler lands than Westover, I still deem a much preferable rotation.

At this season of the year, of course, there is nothing to be seen of crops, except young wheat and young clover. The oats were just being sown, and the land for corn not yet harrowed for planting, but remaining as left by the deep and excellent ploughing done early in the winter. But even at this early season, the fields of both clover and wheat were beautiful. The wheat following corn, (which was on the richest field,) promised better than any I had before seen in that always objectionable succession; indeed, if judged by the growth only, I should have supposed it to be fallow wheat. That however on clover lay, was of course much better.

There are five kinds of wheat growing, and it was remarkable to see such different manner of growth of different kinds, exhibited so early. One object of having so many kinds was to compare their characters and products; and as it is hoped that the results will be noted and reported hereafter by Mr. Selden himself, no more will be here said of the difference of present appearance, or of what he supposes of their qualities. The bulk of the crop is of the Turkey wheat, a kind which he began to raise from a very small stock, 19 or 20 years ago, and which he has continued to prefer, and sow, ever since. He uses great care in fanning his seed wheat, to get rid of all the lighter and smaller grains. This he deems essential to the preserving of a good stock; but with this care used, he does not believe in any wheat degenerating by being continually sown on the same farm. In this, he and his neighbor, Mr. Hill Carter, hold opposite opinions, as stated in a recent communication by the latter to the Farmers' Register.

The clover field was completely covered with green, and nothing but clover to be seen. The remarkable cleanness of the land, and the entire possession that each desired crop has of all the ground given to it, is one of the most striking benefits of his rotation.

Mr. Selden however thinks that one cleansing, or tilled crop, in each rotation, is essential to preserve cleanness, and to obtain a well set crop of clover; though the rotation with clover fallow is more cleansing than without it, even though the one hoed cross (corn) should recur as often, or oftener, as in the three-shift rotation. In proof of the latter opinion, he adduced the fact that wire-grass, which was very troublesome on some parts of his fields, when he commenced his rotation, has been very much diminished, and almost subdued by the present rotation, without any other special care or labor directed to eradicate that pest. He showed me a striking proof of the truth of the opinion, that it is essential to the having of a well-set and clean clover field, that it should be preceded by the hoed or cleansing crop as recently as in his present rotation. In his field which is elsewhere thickly covered by clover, there is scarcely any to be seen on a part bounded by an exact line. The only difference of treatment was, that this part, by some previous difference of cultivation, or change of arrangement of the fields, had remained at rest the year after wheat, instead of being in corn with the balance of the field. During that year of rest it was pretty well covered by a growth of volunteer clover (none being sown on the wheat preceding corn,) and was fallowed and put in wheat with the corn-land of the balance of the field. All alike was sown in clover on the wheat the next February, (1841;) and the result is, that while all the balance of the field of wheat after corn, is completely set in clover, this part has scarcely any clover standing.

Mr. Selden thinks that the best time to sow clover seed is as strictly limited in duration, as the best time to sow wheat; and that that time is generally the last week in February. If sown much earlier, and a warm spell occurs, the seed is apt to sprout, and the plants be killed by succeeding severe cold. If sown much later, and the season be not very favorable, much of the seed may not sprout at all, in time, or the growth be in danger from the summer's drought. But of course it is not possible to come always within this best and short time, and never when sowing after oats—which was going on then—the oat seeding not being finished (March 25th,) and which (contrary to general opinion,) Mr. Selden thought not at all too late for the best prospect of that crop. The clover seed was easily and accurately sown from a seed-box, the advantage of which plan is so great and manifest, that it is strange that any farmer who sees the process can fail to follow the example. The beds being 11 feet wide, the box is made 10 feet long to suit, and is about 4 inches deep, and 3 in width; it is open at top like a trough, and is divided into 10 equal compartments, by cross partitions. In the bottom at every distance of 6 inches, there is bored a hole, (say half an inch in diameter,) each of which is covered by a card or piece of paste-board, through which is *burnt*, by a heated wire, a hole about the

eighth of an inch in diameter. The size of the holes of course must be fixed at first by trial of the rate of seeding. But when once fixed, and the same borer kept for use, there is no more trouble in regulating the rate. The seeding is very regular, and equal. A gallon to the acre is the most that is ever given—and sometimes only 3 quarts, and found an ample allowance. The manner of using this box is for the sower to carry it horizontally across and in front of the middle of his body, supported by a leather strap over his shoulders, and the box kept evenly poised by his hands. He walks at ordinary rate along the middle of each bed, and at every step shifts the box a few inches, first to one side and then to the other. The box is made of light plank only a quarter of an inch thick; and, with seed in every compartment, the weight is not considerable, and the labor light enough. As no skill is requisite, any laborer, at first trial, can sow with perfect accuracy. I had deemed my plan of sowing, by throwing the seeds against a board, (described in a former volume,) to be a very valuable improvement upon the usual mode of casting the seed. But the sowing box is better. And this is an example of how long a simple implement or process may remain almost in disuse, merely because it is not seen in actual operation. This sowing box is pictured and described in Bordley's Husbandry, where I saw it more than thirty years ago, (for it was one of the books read for amusement in my boyhood,) and which I have never since heard of being used, until seen now. There is another machine described in that same book, for gathering clover seed, by a comb-edged box on wheels, or barrow, drawn by a horse. I went once to the shop of Jabez Parker to order such a machine to be made, but was discouraged and prevented by learning that he had made but for one order, and that one a long time before.—Hence, I concluded, as of the sowing box, and as most farmers are very apt to conclude of new implements known only by description, that it would certainly have been more in use, if not attended by some insuperable objection. On the other hand, the most *taking* recommendation of any new implement, is that many other farmers have already bought it. Thus, hundreds, (including myself with many much better farmers, whose *names* alone seduced me into the scrape,) formerly bought Clark's thrashing machine, the most unmitigated cheat of a machine of which I ever heard; as to no purchaser was it worth a cent. If agricultural societies were worth any thing, one of their most useful operations would be to cause to be *tried* as well as *exhibited*, all new or improved implements, by having the trial executed by a judicious farmer, and causing to be published his report of the result. Such *practical* and *disinterested trials* of implements would bring into use all that deserve it; whereas, the mere *exhibition* of new implements and machines at the show of an agricultural society, is rather calculated to aid the success and progress of humbug and deception.

There was one practice seen, and which seemed by the results to justify Mr. Selden's approbation, which I would otherwise have thought certainly wrong, and have always acted and advised otherwise. This is, the *not* cleaning out the water-furrows between the beds, but on the contrary rather working so in preparing for and covering the seed wheat, as partially to fill up and level the existing furrows. I had always supposed that any land requiring beds and water-furrows, for better drainage, would require that the furrows should be kept open and clean. And also, supposing that any plants growing therein would perish with wet, or at least be feeble and produce poorly, it was inferred that it was even better for economy to have a deep, narrow water-furrow, open and clear of all plants, that the shoulders of the furrows, or outsides of the beds, might be better raised, and safer from wetness. Mr. Selden however, thinks differently, and says that both the wheat and clover grow as well, generally, in the furrows as on the beds, excepting from the greater depth of soil and greater fertility of the crowns of the ridges. Even this difference does not prevent the heads of wheat, when grown, appearing nearly level. On spots particularly subject to wet, only, he has the water-furrows kept deep and open. It is certain that at the time of viewing, the wheat in the furrows where not opened seemed none the worse for being so low. It may yet be questioned whether land whose texture and surface will permit such treatment, though a clay loam, and nearly level, as is this farm, might not be cultivated level, or without beds, safely, and yield as well. Mr. Selden thinks that even if this were so, it is more economical of labor in ploughing to have beds. One of the gains which he counts upon, is the space left unbroken and covered by the meeting on the old water-furrow of the two first furrow-slices thrown, in reversing the beds, when turning in the clover lay for the next crop of wheat. The space so covered by the large ploughs used, must be at least two feet in the bed of eleven feet. However contrary to reason, as some might suppose, Mr. Selden, and most other good farmers hold with "Arator" that there is no disadvantage in leaving this covered strip unbroken. The so leaving it, certainly makes much neater and easier ploughing, and in a greater degree than the mere saving the labor of ploughing two more furrows.

Upon inquiring of Mr. Selden what were his views as to applying manure on the surface, he said that he carried out manure, and so applied it without the fear of loss, at any time of the year, when he had it to dispose of, and the labor was convenient. He preferred, however, to plough under the unrotted farm-yard manure that was to be used for the corn crop. He was then hauling out wheat straw from the stack, and spreading it on the clover field at the rate of about 18 or 20 large ox-cart-loads to the acre. This quantity, when spread, was so thick that I should have feared it would smother much of the clover; but was told there was no danger of that result. But though this top-dressing will be no doubt highly beneficial to the clover and still more to the wheat of next year, I think it would have been far better if applied last summer or autumn, or early in winter. However, it could not be earlier here, as the carts have been hauling out the straw (of a crop of 5000 bushels of wheat made last year,) as long and as often as the limited force, and the other heavy demands for labor permitted. One of the younger farmers present, who would not presume to compare either farming knowledge or practical operations in any respect with Mr. Selden,

had used straw to considerable extent in like manner, but much earlier, and therefore as he deemed more profitably. This was last summer, and only on the galled and poorer spots of his reaped wheat field, sown in clover the preceding spring. The clover on such places already is better grown than on the immediately surrounding and better ground. As much as convenient of this straw was carried out to the field as thrown out from the thrashing machine, in return loads of the carts bringing in wheat from the field. This saved nearly all the cost of carriage; and the carts were loaded (carelessly and but partially) with less labor than would have been required to put the same straw on the stack. Besides, if the loaders in the field had any spare time between the departure of one cart and the arrival of another, they could be profitably employed in spreading the return loads of straw.

To this *late* application of straw, by Mr. Selden, which could not be helped, I must add one other fault in his management which he might and ought to have avoided, as he has been throughout a regular reader of the Farmers' Register, where he might find more correct views on this head. Having recently bought a vessel load of slacked but still caustic stone lime, he had 500 bushels of it spread over the litter in his cattle yard. The action of the quick-lime on the dung and other most putrescent parts of the manure will necessarily be injurious, and more or less destructive of the enriching principles.

Mr. Selden uses lime largely, and to great benefit. He applies it in the manner described in vol. i., as then practised by the late Fielding Lewis of Weyanoke, about 72 bushels to the acre. Oyster shells cost 62 1-2 cents the hogshead of 18 bushels. Latterly, slacked stone lime is brought by vessels from New England, loaded in bulk, which may be bought for 10 or 11 cents on contract. It has been sold here as low as 9 cents. It is cheaper, Mr. Selden thinks, than using water-borne marl; which is gratifying to learn, as all farms on tide-water may be as cheaply supplied with lime, whereas but few (requiring it) can obtain marl by water carriage. Mr. Selden never fails to find satisfactory benefit from his liming. He has not yet quite dressed all his arable land. As soon as gone over once, he intends to begin a second application in smaller quantities.

Gypsum is sown regularly on every clover crop, and generally, though not always, with good effect. From failing formerly, Mr. Selden was induced to believe that it was less effective if sown before the severe frosts were over; and therefore always delays the application until after that danger is passed. In this opinion, he must be mistaken.

Though clover is greatly improved by the liming, yet it stood well on all the farm even before lime was applied. That, and the effectiveness of gypsum also in advance of the liming, would alone suffice to prove to me that the soil was originally rich, "neutral," and of admirable constitution, even if its appearance and texture did not teach the same.

Mr. Selden is of opinion that the growth of oats is more exhausting than wheat; but deems the crop essential to farm economy, in the greater cheapness of feeding horses by using part oats, with the straw, instead of with all corn and corn fodder. His regular mode and measure of feeding his work mules are as follows for each one: morning, two quarts of corn alone; noon, one quart of corn and half a bushel of cut oats; night, one quart of corn and a bushel of cut oats. On this allowance, if it be certainly and regularly given, Mr. S. considers that mules cannot fail to keep in good order, while doing good work. It is very certain that the ploughing teams of Mr. S. are kept in good order; and all who know the rotation and manner of tillage at Westover, know that unusually heavy ploughing labors are performed. No corn fodder gathered, or hay made or used. For the usual business of pulling of corn fodder there is no time or labor to spare; and none is pulled, except a little for the sheep; and the clover is given as manure to the land it grows on, instead of being mown for hay. Thirty acres of the richest part of the land in corn the preceding year are annually put in oats, and the crop is an ample supply for the 12 working mules and 3 horses kept on the estate. As the oats grow on the richest land, of course there is so much the more of straw in proportion to the grain, and the chopped stuff is much poorer than is usual of oats from poor land.

Most persons may find advantage in comparing practically and accurately, the above mode of feeding with their own, or that which is usual where plentiful or sufficient feeding is *intended* to be allowed. This allowance is, for each mule or horse, from 6 to 10 *ears* of corn, (selected at the discretion of the ploughman, who of course picks the largest size,) thrice a day, and as much corn fodder in the rack as the animal will eat, and more for his waste.

The readers of the Farmers' Register may remember that Mr. Selden, in his first communication, vol. i., lamented his not being able to make more use of oxen, owing to the fact of his cattle being so subject to die of distemper. Upon inquiring concerning that matter, I learned that there had been no case of that strange disease on his farm for some years. He attributes his exemption, (and thinks that the same means of prevention will serve every where,) to the use of a mixture of salt, sulphur and tar, kept constantly in troughs for the cattle to lick at will, through summer and autumn. I have heard from another experienced and observant farmer, the assertion of the like confidence in that preventive medicine. This distemper is a most mysterious disease; and it is much to be regretted that so few of the remarkable facts of its prevalence and disappearance have been made public. During the time that its frequent occurrence at Westover was a serious obstacle to the full use of oxen, and since to this time, on the Coggins' Point farm, immediately across the river from Westover, there has not been a known case of that disease in 29 years. Nor have I known of a certain case in the neighboring part of Prince George county during that time; though such may possibly have occurred, and even on my own farm formerly, without the true character of the disease being suspected. Indeed, while the distemper has been most destructive elsewhere, it is not understood to have existed in that neighborhood since about 1780, when, in the course of two summers, more than half the cattle of the county, and especially the fattest, died of distemper. This I have

heard from William Weeks, an intelligent observer, and now the oldest man living in that neighborhood.

Mr. Selden's oxen now (raised on the farm) are much finer animals than are often met with in eastern Virginia. He sold two pairs not long since to be worked at the Navy Yard, Portsmouth, for $100 the pair, which is about double the usual price of what are called *very good* oxen. Those we saw at work would prove that his cattle fare well, and likewise that the cause of the distemper is not (as some suppose) to be found in clover, or other good grass, being plentiful, and the cattle being fat.

The Hessian fly, so destructive to wheat elsewhere and generally, is not found to be any important cause of diminution to the crops at Westover. If sown in good time, (say commencing the 10th of October,) and the land is good and well prepared, the vigor of the growth will be sufficient protection against the attacks of the fly. Mr. Selden does not doubt but that these insects are numerous in his wheat, and does not suppose that their depredations are harmless. But at least they show such little effect, as never alone to have prevented the making a good crop from good land, other circumstances being not unfavorable.

In my own practice, I have found no such exemption from this infliction. But my land was not only much less fit to bear heavy crops of wheat, and my cultivation far less perfect than here, but also, the wheat fields were not grazed and gleaned after harvest by stock, and therefore all the wasted grains grew to furnish food for an intermediate brood of Hessian fly. And if there are successive broods of the fly, this must be a very efficient means to nourish and increase them. I am now convinced of my error in adhering so entirely and so long to the non-grazing system. Besides the benefits that I would count on to the stock from gleaning the wheat fields after harvest, and the preventing the growth of volunteer wheat to sustain a new brood of Hessian fly, Mr. Selden thinks that the partial grazing of the field, or rather the trampling which accompanies it, is essential to the best success of the clover sown on the wheat. And if the grazing after harvest is beneficial, for this reason, on the stiff loam of Westover, it must be much more necessary and desirable on soil too light to be well adapted to wheat.

OIL AND STEARINE FROM LARD, &c.

Published by the National Agricultural Society.

[The following communication on the subject of oil and stearine, has, on request, been transmitted to the Commissioner of Patents, and will be read with interest.]

Stearic acid, or stearine, as it is improperly called, is the solid constituent of fatty substances, such as oil, tallow, lard, &c., and which can be separated in a crystalline form by saponification with alkaline matter and abstraction of the alkali by an acid. By this process fats are convertible into the stearic, margaric, and oleic acids combined, to separate which alcohol is used, which holds the two latter in solution after having dropped the stearic acid in crystals.

Pure stearic acid is prepared thus: boil together in the proper equivalent proportions a solution of an alkali, say potash with tallow; by this process a soap is formed; of this soap dissolve one part in six parts of hot water, then add to the solution 40 or 50 parts of cold water, and set the whole where the temperature is about 52° Fahrenheit. The bistearate and bi-margarate of potash, pearly in appearance, fall to the bottom, which are to be separated by and washed upon a filter. An additional quantity of these salts is afforded by evaporating the filtered liquor, saturating with an acid the alkali left free by the precipitation of the above salts, and then adding water. By a repetition of this operation, if conducted carefully, the solution is freed from all of these solid acids, leaving therefore nothing but the oleic. After having washed these bi-salts, digest them in twenty-four times their weight of boiling alcohol of specific gravity 0.820, upon cooling the bistearate precipitates, while the greater part of the bi-margarate and the remainder of the oleate is held in solution. By redissolving in alcohol as before, the whole of the bi-margarate is got rid of, leaving the bi-stearate alone, the purity of which can be tested by decomposing a small portion in water at the boiling temperature with hydrochloric acid, letting it cool, washing the stearic acid obtained, and exposing it to a heat, which, if pure, will not melt in water under 158° Fahrenheit; should it fuse at a lower temperature, it is to be inferred that there is more or less margaric acid present, to get rid of which repeat the solution in alcohol in the mode as directed before.

We then have *pure* bi-stearate potash. From this we separate the stearic acid, by decomposing it in boiling water with hydrochloric acid. The stearic acid which falls down, is to be washed by melting in water, cooled, dried and dissolved in boiling alcohol, from which crystals will fall during refrigeration.

Thus obtained, the stearine contains combined water, from which it is difficult to separate it.

In June, 1825, a patent was granted in England to Mr. Gay Lussac for making these candles, but owing to their comparatively great cost, they could not, although superior to other kinds, be introduced into general use. Lately, however, the great objection has been obviated by the many improvements which have been made in the *modus operandi* of manufacturing these candles. The substitution of lime for potash in saponifying, is one of the most important; and to such perfection has the process now been brought, that the London block, containing only 3 per cent. of wax, and from which these candles are made, bears so handsome an appearance, and is of so good a quality, as to render it difficult to distinguish it from the most refined product of the bee.

The following is the process by which these candles are made on a large scale, both in England and France:

Tallow, lard, or any fat, is boiled with quicklime and water in a large vat, by means of perforated steam pipes distributed over its bottom. After several hours' active boiling, the combination becomes sufficiently complete. The stearate thus formed is allowed to cool until it becomes a concrete mass; it is then to be dug out, transferred to a suitable vessel, and decomposed by a sufficient quantity of sulphuric acid. This de-

composition of the soap, says the patentee, should be made in a large quantity of water, kept well stirred during the operation, and warmed by steam introduced in any convenient way. When the mixture has stood sufficiently long, the acid of the fat or tallow will rise to the surface, and the water being drawn off, will carry the alkaline or saline matters with it, but if the acids or tallow should retain any portion of the salts, repeated portions of fresh water must be added to it, and the whole well agitated until the acids have become entirely freed from alkaline matter.

The washed mixture of the three acids, stearic, margaric, and oleic, is next drawn off into tin or other suitable pans, and allowed to cool, and then reduced to thin shreds by a tallow cutter—an instrument used by all tallow chandlers.

The next step is to encase the crushed mass in canvass or carga bags, and then submit it to the action of a powerful hydraulic or the stearic cold process, a machine made for the purpose. By this means a large quantity of the oleic acid is expelled, carrying with it some little of the margaric. The cakes, after considerable pressure, are then taken out, and again subjected to the action of steam and water; after which the supernatant stearic acid is run off into pans and cooled. The cakes are then reduced to a coarse mealy powder by a rotary rasping machine, put into strong canvass bags, and submitted to the joint action of steam and pressure in a hydraulic press of appropriate construction, called Maudelay's stearine cold press. By these means the stearic acid is entirely freed from oleic acid. It is then subjected to a final cleansing in a tub with steam, melted and cooled in clean vessels. These cooled masses, owing to their crystalline texture, are unfit to be made into candles, it is therefore necessary to crush them into powder, and fuse along with it in a plated copper pan a sufficient quantity of arsenious acid. The stearine is now ready to be moulded into candles.

The wick to be used in the manufacture of these improved candles is to be made of cotton yarn, twisted rather hard, and laid in the same manner as wire is sometimes coiled round the bass strings of musical instruments. For this purpose straight rods or wires are to be procured, of suitable lengths and diameters, according to the intended size of the candle about to be made; and these wires having been covered with cotton, coiled around them as described, are to be inserted in the candle moulds as the common wicks are; and when the candle is made, and perfectly hard, the wire is to be withdrawn, leaving a hollow cylindrical aperture entirely through the middle of the candle.

C. MORFIT.

Philadelphia, February 16, 1842.

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Mode of manufacturing Elaine and Stearine from Lard, &c. : Patented by John H. Smith, 122 *Front Smith street, New York city.*

To all whom it may concern : Be it known that I, John H. Smith, of the city of Brooklyn, in the county of Kings, and state of New York, have invented a new and useful improvement in the manner of separating from each other the elaine and stearine which are contained in lard, by means of which improved process the operation is much facilitated, and the products are obtained in a high degree of purity ; and I do hereby declare that the following is a full and exact description thereof:

The first process to be performed upon the lard is that of boiling, which may be effected either by the direct application of fire to the kettle, or by means of steam ; when the latter is employed, I cause a steam tube to descend from a steam boiler into the vessel containing the lard ; this tube may descend to the bottom of the vessel, and be coiled round on the said bottom so as to present a large heating surface to the lard, provision being made for carrying off the water and waste steam in a manner well known ; but I usually perforate this tube with numerous small holes along the whole of that portion of it which is submersed below the lard, thus allowing the whole of the steam to pass into and through the lard. To operate with advantage, the vessel in which the boiling is effected should be of considerable capacity, holding say from ten to a hundred barrels. The length of time required for boiling will vary much, according to the quality of the lard ; that which is fresh may not require to be boiled for more than four or five hours, whilst that which has been long kept may require twelve hours. It is of great importance to the perfecting of the separation of the stearine and elaine, that the boiling should be continued for a considerable period as above indicated.

My most important improvement in the within described process, consists in the employment of alcohol, which I mixed with the lard in the kettle, or boiler, at the commencement of the operation. When the lard has become sufficiently fluid, I gradually pour and stir into it about one gallon of alcohol to every eighty gallons of lard, taking care to incorporate the two as intimately as possible ; and this has the effect of causing a very perfect separation of the stearine and elaine from each other by the spontaneous granulation of the former, which takes place when the boiled lard is allowed to cool in a state of rest. I sometimes combine camphor with the alcohol, dissolving about one fourth of a pound in each gallon of alcohol, which not only gives an agreeable odor to the products, but appears to co-operate with the alcohol to effect the object in view ; the camphor, however, is not an essential ingredient, and may be omitted. Spirit of lower proof than alcohol may be used, but not with equal benefit.

After the boiling of the lard with the alcohol has been continued for a sufficient length of time, the fire is withdrawn, or the supply of steam cut off, and the mass is allowed to cool sufficiently to admit of its being laded, or drawn off into hogsheads, or other suitable coolers, where it is to be left at perfect rest until it has cooled down, and acquired the ordinary temperature of the atmosphere ; as the cooling proceeds, the granulation consequent upon the separation of the stearine and elaine will take place and become perfect. The material is then to be put into bags, and pressed moderately, under a press of any suitable kind, which will cause the elaine to flow out in a state of great purity, there not being contained within it any appreciable portion of the stearine; this pressure is to be continued until the stearine is as dry as it can be made in this way.

The masses of the solid material thus obtain-

ed are to be remelted, and in this state to be poured into boxes or pans, of a capacity of ten or twelve gallons, and allowed to form lumps which I denominate blocks; then when removed from the vessels and piled, or stacked up for a week or ten days, more or less, the room containing it should be at a temperature of nearly 80°, which will cause a sweating or oozing from the blocks, and they will improve in quality; the blocks are then to be rolled into cloths or put into bags, and these placed between plates, and submitted to very heavy pressure by means of a hydraulic press. After this pressure it is brought again into the form of blocks, and these are to be cut up by means of revolving, or other knives, or cutters; the pieces thus obtained are to be put into bags, and subjected to the action of hot water, or of steam, in a press, until it becomes hard enough to be manufactured into candles, or put up for other purposes to which it may be desired to apply it.

The manner of subjecting it to the action of heated water, or of steam, is to place the bags containing the stearine in a box, or chest, into which heated water, or steam, may be introduced, but not to such extent as to fuse the stearine. A follower is then to be placed against the bags contained in the box, or chest, and moderate pressure made upon them; the material will now be found to have acquired all the required hardness, and to posses a wax-like consistence, such as would generally cause it to be mistaken for wax.

I am aware that alcohol has been used for the purpose of separating elaine and stearine from each other in analytical chemistry, but the lard or other fatty matter consisting of these substances, has, in this case, been dissolved in the heated alcohol, and the whole has been suffered to cool together; this process would be altogether inapplicable to manufacturing purposes, as the cost would exceed the value of the product. In my manufacturing process, instead of dissolving the lard in alcohol, I add a small proportionate quantity of the latter to the former, the whole of which is driven off at an early period of the ebullition, but by its presence, or catalytically, disposes the elaine or stearine to separate from each other, which they do after long boiling and subsequent cooling. I do not, therefore, claim the use of alcohol in separating elaine and stearine from each other, by dissolving the fatty matter in heated alcohol, and by subsequently cooling the solution; but what I do claim as of my invention, and wish to secure by letters patent, is the within described method of effectively promoting their separation, by incorporating alcohol, highly rectified spirits, with the lard in small proportionate quantities, say one gallon, more or less, of said alcohol, or spirit, to eighty gallons of lard, and then boiling the mixture for several hours, by which boiling the whole of the alcohol will be driven off, but will have left the elaine and stearine with a disposition to separate from each other on subsequent cooling, as herein indicated and made known.

JOHN H. SMITH.

Witnesses,
T. H. PATTERSON,
H. S. FITCH.

ON THE DIFFERENT SCHEMES OF ROTATION.

To the Editor of the Farmers' Register.

In your February number there is a very interesting paper, over the signature of N., on the subject of rotations. Being myself an ardent votary to the cause of agriculture, and having had some little experience on the subject of rotations, and being still in quest of truth, or rather light, upon the subject, I am induced to comply with the request of my brother farmer, in my poor way, as far as my limited experience and observation extends, upon the subject of his inquiry.

Looking to experience as the only correct teacher in agriculture, and having had so few successful pioneers in this art, in this our much abused and maltreated tide-water section of Virginia, that it has become, or was necessary until recently, (as we have now many more good farmers in the field than formerly,) for every one that wished to improve his lands, or his husbandry, to experiment for himself; it has therefore fallen to my lot to have tried most of the rotations of the different gentlemen as brought in review by N. That most or all the gentlemen mentioned by N. are successful cultivators, and improvers of the soil, I do not doubt, and that all have done well under the rotation followed by each; but it does not follow that some, if indeed not all, might not have done better under another rotation, and I hardly suppose that either gentleman would contend that his was a perfect system. Let us then first examine a little into the three field rotation, as recommended by Tabb, Roy, and Harrison; as, if my memory does not deceive me, that was the rotation recommended by those gentlemen. Mr. Tabb, then, in the first place, owns one of the finest estates in all Virginia, or perhaps naturally in America; when I say naturally, I mean original fertility of soil, and one that perhaps, with almost any tillage, it was impossible to wear out, being of the very best description of Gloucester low grounds; a soil perhaps of several feet in thickness, unless sooner coming in contact with marl or some calcareous earth, which is the underlying stratum of this soil. Superadded to this, Mr. T. is a very judicious man in all his affairs, and a most excellent cultivator and improver of the soil; and also having it in his power, if necessary, to draw from extraneous funds to aid in his farming operations. And, if I mistake not, Mr. Tabb has a fourth of his farm in a standing pasture, which enables him to keep a very large stock, by which means he is enabled to apply a very large amount of animal and animalized matter to his land, independent of the clover and other vegetable matter grown on the fields cultivated. Is it to be wondered at that, under all these peculiar advantages, Mr. Tabb's land should do well and even produce abundant crops under the three-field rotation? Advantages that scarcely any lands in the state are subject to, to wit: being naturally rich, producing perhaps, when cleared, 10, 12, or more barrels of corn to the acre, a soil almost inexhaustible; for many years under the excellent management of its owner, with every adventitious circumstance that could be desired; I say it is not to be wondered at that it should do well under the three-field rotation of corn, wheat and clover. But if I mistake not, there is some fallowing in the way too, with Mr. Tabb, so that I

think a part of his land does not come under a hoe crop but once in six years. Now surely it could not be advisable to put an old worn out estate of naturally poor land under the same system as Mr. Tabb's, if we desire or expect a rapid, or indeed improvement at all.

Let us now take a view of Mr. Roy's estate, with his three-field rotation. Mr. Roy's estate lies in Mathews, the adjoining county to Gloucester; his land, not originally of the naturally fertile soil of the Gloucester low grounds, but still I believe it was what we call good land, of character to retain all that is put on it in the way of improvement. I do not know that he has used marl or lime; if he has not used the latter, it must be because he does not think his land requires it, as he could I suppose easily command it in any quantity and at a cheap rate. But this I know, that he, his manager, and his father before him, have been good manurers, and if I mistake not, he manures the greater part of his field intended for corn every year that it comes into cultivation; so that I should not think it at all strange that his land should improve under the three-field rotation. But it must be kept in mind that, situated as Mr. Roy is, immediately on an inlet of the Chesapeake bay, he has access to as much sea weed as he can use, and perhaps other resources for making manure, that are not available to every one, and no one ever doubted that if you could manure your land every year, it would improve under an annual tillage. Whether the Mathews lands succeed well in fallow for small grain I am not advised; if they do not, doubtless the three-field rotation may be the most profitable they can adopt. But even that I should doubt; as a longer action of the atmospherical influences upon the same surface, together with the increased quantity of stock and manure, which a more lengthened rotation would admit of being kept and made, would, I have no doubt, with less labor, produce a greater amount of crop.

We will now visit Brandon, and see if Mr. Harrison enjoys no facilities for improving his land, other than are common to farmers generally. There can be no doubt but that the land on the Brandon estate must have greatly improved under the occupancy of the present owners, as I have been credibly informed that the product is now double of what it was under the regime of the father of the present occupant. But I am rather under the impression that some of the Brandon land is under the four-field rotation, and that they fallow on at least a portion of the estate. But be that as it may, I have always heard that the land on that estate was originally good, if not rich; it is also, I believe, a fine wheat soil, and well adapted to clover, and I presume the plaster acts well. I believe now the lands of those estates are all limed or marled; how much they had improved before they commenced liming, I am not aware. Another advantage I think I have heard those estates enjoyed was, that of an extensive marsh or piece of wet land, too wet for cultivation, but affording good pasture to a large number of cattle, thereby indirectly adding another field to the rotation, grazing the cultivated fields only at certain periods of the year, giving the arable lands the benefit of all the manure they make both winter and summer; and I presume grazing is allowed partially at particular seasons. I do not, therefore, Mr. Editor, think that either of the farmers alluded to by N., pursuing the three-field rotation, ought, properly speaking, to be held up as models for a general system. Nor do I think it by any means proved that either of these gentlemen, under a more lengthened rotation, with their general good management, would not have arrived at much higher results than they have yet attained. They have no doubt thought it best to "let *well* alone," and in their situations doubtless they were right. But "as one swallow does not make a summer," neither do three good farmers, being comparatively successful under peculiar circumstances in a particular rotation, make that rotation preferable to all others.

As your correspondent N. seems to have passed over the four field-rotation, it might not be necessary that I should notice it in this communication; but as we are writing and speaking for information upon the subject of rotations, I will even give it a word in passing. The Arator four-field system I have seen tried in all its varieties, and have never seen much good corn from it in any way. It is true Arator himself succeeded very well with it at Hazlewood; but no where else that I am aware of. That is, he succeeded very well in bringing back his land to its original fertility, and he made very heavy crops of corn; but never made wheat successfully, as I have been informed. But be it remembered, that Hazelwood was originally of the best description of Rappahannock low grounds. The four-field rotation as pursued on James river of late years by those successful and justly celebrated farmers, Messrs. Carter, Selden, Harrison, &c. &c., on originally good land, of deep soil, with the management of these gentlemen succeeded very well for a time, but the two former have abandoned it, thinking the five-field a better, or even six-field preferable, when circumstances allowed it. This I inferred from their communications a year or two ago in the Register. But there is a four-field rotation which a friend of mine is now trying, which, if he succeeds with making clover take well after corn, will, I think, supersede all others on natural corn land, that is, on land naturally better adapted to corn than wheat, particularly all those extensive flats lying on our tide-water rivers, where corn is the main staple, and navigation at the doors. The rotation then, which my friend is now proposing to try, is simply reversing the Arator four-field system; that is, by following wheat with corn instead of corn with wheat, say thus, 1st wheat, 2nd corn, (sowing clover seed the last time the corn is cultivated,) so that the third year the clover will be at maturity; that year let it ripen and fall on the land, and the fourth year pasture it, and that fall fallow it and sow it in wheat, reserving as much for oats the next spring as the farmer may deem advisable. By this system, if the clover succeeds after corn, you will have the full benefit of the clover crop by protecting the lands from the summer suns as well as the winter frosts, and washing after corn. And the next year the stock (as much by the way as the land will *well* maintain) trampling and breaking the dry vegetable matter to pieces, and depositing their manure and urine upon it, your land will have a fine top or surface dressing of vegetable and animalized manure. The latter I hold to be altogether indispensable to the attainment of a high

state of productive fertility. I say *productive* fertility, because I have seen a great deal of land that was seemingly rich, but would not produce heavy crops of grain, and I believe for the very reason that it wanted the animalized matter and the compactness which the hoof gives it. It being now admitted, I believe, by most judicious farmers that applying manure on the surface and on grass land is the preferable way of using it, my friend proposes applying all his winter-made manure to the clover field the spring after it is sown. The summer cow-pens would of course be on the pasture fields intended for fallow that fall, which being cleansed of a number of pests by grazing and of all over-luxuriant vegetation, with a handsome sprinkling of manure all over the field, and the land, if light, rendered compact, and if stiff, the sponginess removed by trampling, will by September be in a fine state for the plough, and, I should think, of productiveness for the wheat crop. We all know that corn will grow well after wheat, but it is very rarely that wheat ever succeeds after corn. And the reason is very manifest; because in the cultivation of the corn crop, all the productive powers of the land are brought into action, and the wheat following immediately after, before the land has any time to rest from the draught of the most exhausting crop we grow, the natural result must be an indifferent crop of wheat. Whereas, by following wheat with corn, the wheat does not exhaust the land as much as corn, and we have the whole of the aftermath of stubble, clover, grass, weeds, &c., to turn in, as well as giving the land eight months to recuperate its soil on or near the surface. None of these advantages are derived by the wheat after corn. I am aware it is considered bad husbandry in all the good farming districts in Europe to follow one grain crop with another, and I dare say it is; but still I have generally seen corn succeed very well after wheat, particularly on good land. It strikes me this proposed rotation of my friend has but one objection to it, and that may be a fatal one, viz.: the doubt of the success of the clover, after corn. But he is sanguine of success on good land that has been marled. But, as I before observed, I would not advocate this system to the exclusion of the five or six-field rotation on other than lands naturally much better adapted to corn than wheat, and that to be on navigable water, or very contiguous to market.

Having dwelt much longer on this part of the subject than I had intended, we will now pass on to the five-field rotation, which is more particularly the subject of inquiry of your correspondent N., and the only one I intended at first to touch upon in this communication. N. says he has "unconditionally made up his mind to adopt the five-field rotation," and therefore, if I had the disposition, it would be useless to attempt to divert him from it; but in this I have no wish; as from some years' experience I can highly recommend it, as at least a profitable and improving rotation. I will not say it is preferable to any other, or to the six-field rotation; but I know that in a few years a farm may be made to double its production. But to proceed more directly to answer his queries respecting the choice of the two methods pursued by himself, and that of Mr. Wickham, or the common five-field rotation as pursued by most persons who have adopted that number of fields, I unhesitatingly answer, after some experience with both, that I prefer the latter, or Mr. Wickham's plan. I have tried the pea fallow two years after corn, both by cultivating them and sowing broad-cast, the latter moderately, and very thick; but it all would not do, the crab grass, (*Digitaria sanguinalis*,) took possession, and the most indifferent wheat in the field was on the pea land, and no clover followed. In one case I sowed the clover seed, and in the other there ought to have been plenty of seed in the land; but in neither case was there any product. Again, another, and I think a more important objection to N.'s rotation is, there is no time or space for grazing, which with N. I hold to be indispensable on all lands that I have yet seen cultivated; superadded to this, are the objections urged by N. himself—the expense and labor of the pea fallow. Now, as regards the objection urged by Mr. Harrison to the five-field rotation, that it would become too foul, I can answer experimentally, to what probably was advanced by him as an opinion, there is no danger, I can assure him of his land not becoming too foul under that system, but the reverse is the fact, that it is decidedly more cleansing than the old three-field, as the summer fallow is far more effectual in rooting out the briers, shrubs, &c. than winter grubbing and grazing. The fifth year I have found sufficiently cleansing for all good farming purposes. Indeed I think you will find it much more so than the five-field rotation, embracing the pea fallow. The second objection, as suggested by Mr. Selden, I think you will also find a speculative one, as I never sow clover on fallow wheat, and so far I have always had a good crop. But you must understand me, though, all this time as speaking of marled land, as I suppose he was, as our lands without calcareous matter are in the general too poor for good farming in any way.

To the third objection, that of rendering the land too close and compact, by trampling the year before corn, I would say, it will not I think be found to hold good upon trial, as I think, upon such land as N. describes his to be. He will make a decidedly better crop, by grazing than upon a foul field. From some experience in both of the five-field rotations, I should decidedly prefer the No. 2 of N., or Mr. Wickham's. There are two, and only two objections to the five-field rotation that I am aware of, and they might not be applicable to all farms or situations, as to mine; the first is, that of small grain crops following the corn, and the next is, that with me one fifth did not give me pasture enough to enable me to keep stock sufficient for the use of the farm; and if we are to waste as much land in a piny old field, to be called a standing pasture, we had as well make a sixth field, and bring it in regular rotation of cultivation. This latter rotation I think, on lands adapted to wheat, and not immediately available to navigation or to market, is decidedly the preferable rotation of any of the foregoing. If I adopt the six-field system, I would say 1st, corn, 2d, clover sown after corn, 3d, wheat, 4th, clover, 5th, clover, the two last to be grazed but not two heavily, 6th, wheat. By this system one field might be manured annually, and so the whole farm once in six years. As to the quantity of land cultivated, it would be the same with the old or Arator four-field system,

except that there would be one-sixth, instead of one-fourth in corn, and two-sixths in small grain instead of one-fourth, making three-sixths or one-half in cultivation, as in the other. Now locality, nature of soil, &c., must determine every farmer as to the rotation best adapted to his situation and circumstances. But I have no doubt, that upon wheat land the six-field rotation will be found most profitable, and upon all I have no doubt most improving. I am a decided friend to grass and stock. Without the one, we cannot have the other. With good grass we can have good stock with which we can enrich our lands, and give plenty and comfort to all its inhabitants, whether of the biped or quadruped race; and in a little while I know by experience that the *net* return of the long will be better than the short rotation.

Having now, Mr. Editor, answered as far as my experience goes all the queries of your correspondent N., and I dare say by this time you are heartily tired of my prosing, I will subscribe myself, your friend—and a

FRIEND TO LENGTHENED ROTATIONS.

April 9th, 1842.

[If our correspondent had not chosen to withhold his name, he would have been known to be, as we believe, a personal acquaintance and friend of all the individuals whose names he has mentioned, and one who has visited most if not all the farms particularly referred to. But still we think that he is mistaken in regard to some of the circumstances which he supposes to exist, and especially as to the abundance of the means of fertilization possessed or available. But we will not undertake to make the corrections which appear to be needed, lest, for want of proper information, we might also err, and in more important matters. It is therefore left to the farmers named, all of whom have been our much valued correspondents on this general subject, to correct any mistakes deemed in any way important, into which our present correspondent may have fallen.

In respect to the scheme of having clover to follow corn, it would undoubtedly be an improvement of the highest value, if the crop can be rendered at all certain. But, judging from our own experiments of several years' continuance, (as reported formerly in the Farmers' Register,) and which were made in the anxious hope and sanguine expectation of successful results, we greatly fear that this admirable plan of rotation cannot be realized, even on marled lands. But still we are far from desiring to discourage farther and full trials—and shall rejoice in learning that the difficulties and disappointments, to which we were formerly subjected, were not insuperable, and may be obviated by more care and better knowledge.—Ed. F. R.

OPINIONS OF NORTHERN FARMERS CONCERNING LIME.

From the Massachusetts Ploughman.

About the year 1836 or '7, I prepared a compost consisting of 12 loads of peat muck, 4 casks quick lime, and eight loads long manure. On the 20th of June I turned over about three-fourths of an acre of green sward and manured in the hill with the above compost, and planted with potatoes. A more luxuriant growth of vines I never saw, which I attributed to the manure, but have since given the credit to the green crop of grass turned in. Owing to dry weather and early frost the crop of potatoes was rather small. However, I considered the theory on the use of lime well established, not only by the result of my experiment, but I had most of the agricultural papers on my side. The next spring I purchased 50 casks of lime which I used in nearly half as many different ways, the last of which was to place about a dozen loads of lime and peat muck compost around the roots of some apple trees, to prevent the grass from growing, which succeeded to admiration, and this I am convinced is the only benefit I have ever derived from the use of lime as a manure. This is the only essential humbug that agricultural writers who are better versed in theory than in practice have ever fastened upon my shoulders, and probably will be the last for some time to come, for my confidence in what they say is almost entirely lost.

[We congratulate "A Highland Farmer" that he has escaped with so little loss as the expense of 54 casks of lime and the labor of applying it to his fields.

The idea of destroying the whole grass crop under his apple trees by spreading on lime is not bad. Lime will kill the *sward*, the *canker worms*, and the *manure* with which it is mixed—it is much more certain to kill than to assist the growth of vegetation; and if it were not too costly we would recommend it to be spread on thistles, bushes, &c., which are to be destroyed.

In regard to the theories on farming, published by those who have no experience in the business, we are inclined to think that lime will have no effect on them. Their authors have wallowed in lime till their coats are as white as their hands—and still they crawl about and show signs of life, crying lime! lime! They wonder that farmers are so stupid as to doubt the value of lime; yet the only evidence they can adduce in its favor, on our New England soils, is from theorists who have made no actual trials of it.

Ever since we first commenced the publication of the Cultivator we have plainly expressed our own views in regard to lime, and we have called on those who might differ from us to exhibit their evidence in its favor. But we receive *no evidence*. We have *opinions* as thick as cranberries, but no evidence that can be relied on to show the superior merits of lime in agriculture.

Beginners in farming who have no ideas of their own must copy what others have written—they are ambitious of making a noise about something or other and they may as well rant about lime as to bawl in favor of Durham cattle which they are driving about the country for sale.]—*Editor of Ploughman.*

[The first of the foregoing paragraphs is an ex-

tract from a communication to a late number of the Massachusetts Ploughman, and the balance is the comment thereupon, by the editor, who is also understood to be a practical and experienced farmer. The liming farmers on James river might adduce their large experience, and a large part of their present increased productions and profits, as proofs of directly the opposite of the opinions above stated. We had before learned that liming in Massachusetts had been attended with but little profit—for what reason we had too little knowledge of existing circumstances to pretend to determine. But we would not have expected, from any degree of such ill success, whatever, in recent and limited trials of a new practice, so sweeping and general a condemnation of lime as manure, and so dogmatical and entire a denial of good effects, which so many thousands of practical and prosperous improvers have believed in and asserted. It would have been much more like philosophical inquiry, and more likely to be conducive to the profit of the inquirers, to search, by investigation and experiments, for the peculiar circumstances, whatever they may be, which (according to facts stated above) have prevented liming in Massachusetts having the good effects undoubtedly produced by liming elsewhere. —Ed. F. R.]

REMARKS ON THE PRESENT CONDITION AND OPERATION OF THE BANKS OF VIRGINIA, AND THEIR PROSPECTS.

We had designed to state generally the result of the latest legislative action on the banks of Virginia; but that action was not completed until just before the rising of the egislature, and too late for the last number of the Farmers' Register. We shall now give a general and cursory view of the existing condition of things connected with our fraudulent banking system and its operations; which condition will probably remain until new legislation shall vary it, or until the growing distrust of bank solvency, and growing popular indignation and execration, shall operate to close the banks, and put an end, for a time, to the whole system of legalized falsehood, fraud, and villany.

It is not worth while to state particularly what is the purport of the existing banking laws of Virginia, as fixed by the latest act. Indeed, we doubt whether a single member who voted for the last law has any correct or definite opinion of the actual measure of obligation, or of penalty for violation of obligation, now imposed on the banks; or whether any two lawyers, if consulted, and advising deliberately, would agree in opinion thereon. The presidents of the banks in Richmond, it is generally understood, have written the new provisions of indulgence of most or all the bank relief laws that have been enacted since 1837; and at any rate, whether from the restrictions being thus cunningly devised for the purpose of being *total'y inoperative*, while seeming to threaten awful penalties on bank failures and frauds, or whether the stupidity of legislators has alone served to reach this same desired result—it is certain that all legal penalties on the banks are, by various obstacles, rendered totally unavailable to the injured and cheated individuals who would *dare* to seek legal remedy for their wrongs, and for the frauds practised on the whole community. The legislature of Virginia, during its whole course of collusion with and thorough support of fraudulent banks and fraudulent banking, has not ventured *directly* to violate the constitution so far as to forbid individual creditors to collect debts from the banks in any and every legal mode to which other debtors are subjected. But, in practice, the same end is as completely reached. For when the claim for justice is so beset with difficulties and delays, that to obtain the benefits would cost the creditor more than he would lose by the dishonesty and discredit of his debtor, (the bank thus legalized to swindle,) it follows of course that he will continue to submit to be cheated by the debtor, rather than pay double as much to obtain legal redress as his loss so incurred.

The action of the Cincinnati mob, more than the voice of reason or the demands of honesty, caused the legislature of Ohio to compel the banks of that state to resume specie payments forthwith. The distant but plainly audible mutterings of popular discontent and indignation acted powerfully to produce the similar unlooked for events which have since been consummated, of resumption of payments by the banks (or such as did not avow bankruptcy) of Pennsylvania and Maryland. Thus then the sole excuse for continued suspension in Virginia, (which had been relied on solely because it was thought impossible to cease to serve,) was completely taken away. A little time before, it was the universal cry of all the bankites, from the wise, patriotic, moral and religious leaders and wire-pullers, down to their lowest and basest tools and mouthpieces, that "the banks of Virginia certainly *ought* to resume payment, and *could* safely resume, as soon as those of Pennsylvania and Maryland should resume—but not before." Well! instead of suspension being continued in these

almost bankrupt states, as all these bankite arguers or assertors counted on, for five years more at least, (as assured by the previous law of Pennsylvania,) resumption was suddenly and unexpectedly required and enforced; and, as we predicted, not a word more was said by our bankite orators and editors about resumption in Pennsylvania and Maryland being the only requisite for resumption in Virginia. The lie and the fraud had served its purpose up to that time—and the high dignitaries who had used it, and their most slavish and basest tools who had been continually proclaiming this alleged sole excuse and reason for suspension, quietly dropped it and made no more mention of it than if it had never been used at all to ward off resumption of payments. In the bill then before the legislature there was a provision that in case the banks of Philadelphia and Baltimore should resume payment, the banks of Virginia should also be compelled to resume within 60 days thereafter. This provision was *very well* while no such contingency was deemed possible; and would have served admirably to keep up the delusion, and give countenance to the bank falsehood and fraud founded on the suspension of northern banks. But while the bill was yet in progress, the legislatures of these two states actually passed their laws to compel their banks to resume—and our legislature *therefore* at once struck out the provision founded thereon. It could no longer serve its *designed* purpose of deceiving the public.

The recent bank relief laws require the banks to resume payment on the first day of next November. But, unless other extraneous circumstances shall before that time arise to enforce the requisition, there will be no *real* resumption then, but only such pretended and falsely asserted resumption and continuation of specie payments, as existed in February and March, 1841. The branch bank system of Virginia, (which alone would serve to render any banks irresponsible, and therefore corrupt and dishonest,) of itself will suffice to protect the banks from paying any thing worth notice for a month, or for several months. And within one month the legislature will be in session, and ready to grant any desired relief to the banks, and continued indulgence to suspension. Long before November shall arrive, as formerly, the notes of the different branches will be so exchanged that it will be very rare to see any bank note in circulation near the branch where only it promises to be payable. The Wytheville notes will be issued in Norfolk, and Norfolk notes in Clarksburg, &c. The banks will claim not to pay deposites except in "current funds," which term means the worst bank notes that the bank may choose to receive at that time and for that purpose; and though this impudent pretension and claim has no legal validity whatever, still in practice it will be maintained by the banks. Still further, the merchants are the drawers of nearly all the checks presented—and they will draw them only for "current funds." With these several strong means of protection against paying their honest debts, the banks could keep off any considerable practical resumption of payments, as well as they now avoid paying their notes for one and two dollars, which are now by law payable in specie, and which they take care to issue far away from the place of payment.

So it is, and we grieve to admit it—that the banking system of Virginia, as permitted and sanctioned by the legislature, is now more degraded in regard to honesty, and in reputation, than any we know of in all the Atlantic and most of even the western states. And there remains no hope for relief, either in the banks' forbearance to continue their frauds, or in the legislature enforcing sufficient penalties to prevent bank frauds. And full and sufficient causes of this deplorable prostration of the character of this once noble and universally honored commonwealth, are to be found in *the existing partnership of banks and state in the trade of fraud, and the enormous indebtedness of the body of bank directors and also of members of the legislature to the banks.* The reports of the bank committees recently made to both houses of the legislature sufficiently expose these astounding and deplorable truths.

From these reports appear the following important and curious facts; and for more full proof of all, and of more than we have time to charge, we refer to the two reports, and earnestly wish that they could be read by every honest citizen:

That 55 members of the last General Assembly of Virginia were then debtors to banks, in the gross sum of $111,675:

That the bank directors (so far as reported, and the reports not being complete,) were indebted to the banks, as principals and endorsers, individually or as members of commercial firms, $2,321,080, or nearly one fourth of all the capital of all the banks in the state.

The directors of the lately established Exchange Bank deserve especial notice and applause, (considering that they are such new hands at the business,) for their expertness in getting the lion's share of the spoils. The reports to the legislature show the following amount of loans and liabilities:

Capital of the Exchange Bank and its branches, - - - - -	$1,782,037
Loans to and liabilities of its directors	734,930

Or more than two-fifths of the whole capital.

Capital of the Petersburg Branch of Exchange Bank - - -	$475,000
Loans to and liabilities of its directors	$219,606

Or nearly one half of the capital.

But the *crack* operators are certainly the directors of the little Branch (Exchange) Bank at Clarksville.

Capital stock, nominally $200,000, but paid in only - - -	$175,000
Loans to and liabilities of its 7 directors, - - - - -	$233,914
Or more than its whole capital by	$58,914

This we take to be the *ne plus ultra* of what are considered honest banking operations, for the accommodation and profit of bank directors.

Let it be observed that a director might be indebted to half a dozen banks, and no doubt many are indebted to several, and yet no more of his indebtedness appears in this report, than his debt to the particular office in which he is a director. We have known one single family and business connexion to have members as directors in almost every bank and branch in eastern Virginia. As most directors serve, and value their places, *merely* to borrow as much money as possible, it follows of course that they will exchange such friendly favors liberally; and each one who is greedy of large loans will seek them from as many different banks as possible. Thus, independent of all other particular influence, *growing out of family and business connexion*, a bank director has a general claim and influence, superior to other borrowers, in every bank and branch besides his own.

It further appears from the statistical facts of these reports, as drawn from the banks, (and which is precisely such as reason and general truths would have caused to be inferred,) that very few directors have any interest in the banks as stockholders, beyond the exact amount that the law *requires* them to own, to make them eligible to the appointment. This amount is 5 shares—and it is amusing to see in the report how generally each director's stock is of that precise amount. If a single share were enough for that purpose, there would have been as generally no more held. Bank directors are generally well enough informed to know that banking, (as *they* conduct it) is a very bad business for the stockholders—and is valuable only to the *borrowers*. They therefore, for much their greater number, take care to have as little as possible of the stockholding interest, and as much as possible of the borrowing interest in the business. In this town of Petersburg, these truths, (as well as other things important to directors' interest,) would seem to be especially well understood. For of the 21 directors of the 3 branch banks,

1 director, who owns the largest amount, has only - - -	25 shares
2 - - - - own, each,	15
1 - - - - - -	10
1 - - - - - -	7
1 - - - - - -	6
and the other 14 - - -	5 shares only.

The officers (from presidents down to runners included) of the Virginia Bank and its branches, are indebted to them, $36,367, and the officers of the Farmers' Bank and branches, $42,787. This is another powerful influence operating against resumption. The charter of the Exchange Bank prohibited this class of debts, and *therefore* there are none such there to report.

At pages 63 and 64 of this volume, we presented abstracts from the latest official reports of the three principal banks of Virginia, showing some remarkable evidences of the treachery of all these institutions, and the falsehood of the pretension that *they were using the indulgence of suspension of payments to prepare for meeting payment.* In the previous year of suspension, and of asserted and pretended preparation to pay specie at its close, (as required by the then law, and believed in by the duped people,) it appeared from those reports that the proportion of notes in circulation, to coin in the banks, had been *increased* as follows:

	January 1, 1841.	January 1, 1842.
Bank of Va.	$3.10 to $1 coin	3.38 to $1.
Farmers' Bank	3.34 to 1	3.50 to 1.
Exchange Bank	3.53 to 1	2.90 to 1.

And taking a general average, these three institutions had, during that year (1841,)

Increased their outstanding debts,	$667,462,56
Increased their circulation,	380,983,33
Decreased their specie,	27,581,23
Making total increase of liabilities,	
or of greater *inability to pay specie*,	$1,076,027,12

When we first prepared that abstract, the reports of the small western banks had not been published. Their statements are embraced in the later report of the senate, and they vary the above average a little, but not materially. That report also differs from the above, in comparing the time of April, 1841, (date of commencement of the last *avowed* suspension,) with January 1, 1842, or less than the nine last months of "preparation to resume payments;" and the general results are, that all the banks of the state, in that time, had

Increased their discounts, -	$343,016
Increased their circulation, -	859,165
	$1,202,181
Increased their specie, - - -	260,628
Which deducted, leaves of general increased liabilities, or increased inability to resume payments, - -	$940,553

We could defy any bankite to produce, from all the annals of the commercial world, between the early times of the South Sea Bubble and of Law's Mississippi Scheme, and the present and recent time of non-paying banks in America, evidence of such gross fraud, and treachery to trust and to every obligation of law and honesty, as the above statement shows, conducted as this has been by men of the highest respectability, and moreover deemed honorable, patriotic, moral, and many of them also straitly religious!!!

Many other facts stated in these reports, though of less importance, deserve to be noticed, as matters of curiosity, or of shameless abuse.

The cost of all the banking houses in Virginia, amounts to $495,495. When sold hereafter, all these bankrupt palaces will scarcely bring the fifth part of their cost. All their business might have been transacted in apartments costing much less than one fifth.

The salaries of all the officers of the banks of Virginia, amount to more than $200,000 a year, or nearly as much as would have paid the legitimate and proper expense of the civil government of the commonwealth, before the commonwealth had become involved in the trade of banking and in debt.

The amount due from the northern banks (of other states,) to those of Virginia is $207,922, and the Virginia banks owe to northern banks, $411,287.

The bad debts at the Virginia bank at Richmond, as reported by the directors - - - - - -	$178,818
And the doubtful - - -	62,982
And as reported by the stockholders as bad - - - - - -	220,000
And as doubtful - - -	97,000

(Neither including defalcations, or totally worthless stocks, we presume.)

But besides this table, there is another reported by the bank of Virginia, showing the "amount upon which no interest has been paid for the last 12 months," to be $630,551. When interest has not been paid on a bank debt for a year, there is generally not much to be expected of the principal. The Farmers' Bank reports a like item, amounting to $249, 014.

Some *partial* light is thrown upon the gross abuse of long continued "*accommodation*" loans. The Virginia Bank and branches, exclusive of those at Lynchburg, Norfolk, Danville and Charlestown, which made no report, "*owing to misunderstanding the question*," have debts which have been due

More than 10 years, - - -	$305,470
Between 5 and 10, - - -	458,018
Between 1 and 5, - - - -	447,031

Of the Farmers' Bank, there are answers to the question on this head, from only the two branches of Fredericksburg and Winchester. We presume that the president of the mother bank at Richmond also "did not understand the question," and that the branch presidents at Petersburg, Norfolk and elsewhere, were no more acute than their superior in Richmond. To show how much self-interest may sometimes blunt as well as sharpen intellect, we will copy from the report this puzzling question which so many presidents ("learned in the law," too,) and directors *could not understand*. It stands first in the list addressed to all the banks, and is as follows: "What amount of debt is due to each bank and branch thereof, which was originally contracted more than *ten* years past? What amount was contracted more than *five* and less than *ten* years past? And what amount contracted more than *one* year and less than *five* years past?"

One more statistical fact will be mentioned, and which only is not derived from the bank reports. It is that the last known sale of Virginia Bank stock, was at $45 the share of $100 par.

We pretend not to argue with, or to instruct any person who is interested in sustaining the banks in their course of fraud; nor any of the many true and honest men whose understandings have been so clouded by bank delusions as to believe that the system is honest and beneficial in its present operation. But, of those who admit the evils and the vices of the banking system of Virginia, and sincerely desire to have them reformed, and who have vainly counted on and waited for those persons having power to reform these institutions, we would ask, what possible ground can there be for such hope from bank officers and directors and from legislators, acting as they have done now for five years, and under influences which still exist? We entertain no expectation of either voluntary or legally coerced reformation. Nevertheless, we have full confidence that either the reformation or the destruction of the fraudulent system *will* come, and *soon*. The banks are taking their full swing of allowed

iniquity. Their directors and users foolishly believe that that is all which is needed to sustain them. But they will find their mistake. The growing depreciation of the notes, the still faster growing discredit and distrust of the banks themselves, the daily growing abhorrence of the whole fraudulent paper money system, and of the conduct of it in Virginia in particular, will all concur to demand and enforce resumption before the laws will *in good faith*. And as we believe that *bona fide* payments cannot be resumed and maintained by banks so crippled, and so deservedly discredited as those of Virginia are and will be, the forced attempt at resumption will most likely produce a final suspension, which will be then called by the true name for all bank suspensions—that is *bankruptcy*. If we are mistaken in the degree of peril of such results to the banks, or as to the time, we cannot be mistaken in this opinion, that the longer they postpone resumption, the greater will be the danger of undisguised bankruptcy from the attempt. Banks of circulation, if paying, cannot stand except when sustained by public confidence—and the banks of Virginia have so acted as to forfeit all claim to trust and confidence.

And now, when all the evils of the previous full sway of the fraudulent paper system are about to be brought upon the whole community—evils which we predicted long ago, and vainly tried to warn the agricultural community against—the cry is raised by the bankites, and will be sounded and echoed much louder yet, that the movements for bank resumption, and the action of opposers of the frauds of the banks, have caused the present and still growing distress. It would be as just and true a charge if all the wretchedness of feeling, prostration of powers, and acknowledged ruin, of a newly sobered drunkard were to be ascribed, not to his intoxicating draughts, or to his having been drunk daily for 10 years before, but to his *finally forced* state of abstinence and sobriety. It is very true, that no improvident debtor can pay his debts without inconvenience or privation—and we have never deemed as a light matter the enormous load of bank debt on the people. But debtors who will not prepare for the inevitable approaching, though distant day of payment, until forced, are generally such as would suffer the less by being thus forced to pay early rather than late. Those earlier debtors who have remained in debt to the banks during the whole past five years of suspension, and are not yet prepared to pay, *never will be prepared*. They are ruined already, or their ruin is inevitable, from their own imprudence; and no greater extension of indulgence can possibly save them. And those who have first contracted standing debts to the banks, during the time of suspension, have been therein no less imprudent, are not the less hopeless, and have no claim whatever that the public should remain under all the burdens and evils of a debased paper currency, until these new and fully warned debtors shall voluntarily retrace their false steps. If there had been any *real effort* made, either by the solvent debtors of the banks to pay their debts, or of the banks to prevent new debts and liabilities being made, the improper excess of debts might have been paid, and all impediments to resumption of bank payments would have been removed, and bank payments honestly and truly resumed, three years ago, and without any serious loss or inconvenience to the country—indeed very far less than has been suffered since, by the continuance of the fraudulent operation of non-paying banks. If great and general pecuniary distress be now pressing on the people in general, as well as on banks and their debtors, and if the pressure should cause ever so much decline in the selling prices of property, it will not be caused (as alleged by the bank organs) by measures for bank resumption, but because of the *long continued delay of resumption*, and the *total failure to prepare for resumption* both by the banks, and their improvident and reckless debtors. These deductions are so plain that they require merely to be announced to obtain the assent of unprejudiced persons. But if any such reader should still believe the current assertion, that it is bank reform, and not past bank abuses (as *we* use the term,) that causes distress, we ask what caused all the commercial and general pecuniary pressure in Virginia in 1841? During that year, as before shown, there had been no contraction of bank loans and issues, but on the contrary an actual increase of issues and of liabilities, to the amount of more than a million of dollars. Surely this reverse and adverse operation to resumption of payments ought to have prevented distress, if contraction and resumption, properly and gradually conducted, would produce greater distress. And the approach to resumption might have been abundantly slow, and yet have been safely reached by the banks before 1840. Resumption of payments, so reached, would have been better for the debtors themselves—better for the permanent stockholders, (not stock-jobbers,) by showing them earlier the true state of their wasted funds—incalculably better for the commonwealth—and better for all, except bank officers and the *borrowing and speculating and bankrupt* interests, to whom bank loans are "the breath of their nostrils," and who must cease to exist when deprived of that sustenance. It is this class that has long directed the banking policy of Virginia,

and governed the state. Its power and action even now are fearfully strong, and are dealing blows of destructive force. But they are but as the dying struggles of the hooked shark, which will soon be quieted by the death of the insatiable monster.

And now, so far as we now know and expect, we shall take leave of this subject—deeming that we have already rendered all the service in this respect to the agricultural interest, and the country, that is in our power. Nor do we believe that our labor has been vainly exercised to expose and to assail the fraudulent banking system, through this, and still more through other publications. The seeds which have been thus sown have not perished; and however little outward show there now may be of growth, the crop will yet be abundant, and the future harvest certain. Within a few years, at farthest, the fraudulent banking system of Virginia will explode, and the fraudulent principle of the system will be universally acknowledged. And, whether such be the result or not, it will be always one of the things of which we shall be most proud, that all our powers, such as they are, have been zealously exerted, though almost unaided and alone, to expose and to contend against this most iniquitous and infamous system. All that we have done, and freely and gratuitously paid, and risked the loss of, for this object—and the meeting and suffering of all the falsehood, slander, and every other act of maligant hostility of bank partisans and bank slaves, that have been brought in vain to bear us down, all will be deemed a cheap price paid for any forwarding of the final overthrow of the fraudulent paper system.—Ed. F. R.

REMARKS IN REPLY TO INQUIRIES AND STRICTURES

On an "Essay on the making, the preserving, and the applying of manures."

For the Farmers' Register.

In the number for March of the Farmers' Register, p. 100, is a neat little modest piece, signed "A Young Farmer," in which the writer of a certain essay on manures is called on to answer certain inquiries. I now avow myself as the author of that essay. For certain reasons, which even now I am not at liberty to disclose, the essay appeared, contrary to my usual wont, in an anonymous form. I greatly prefer that the productions of every man should appear with his own name appended thereto. The little that the "Young Farmer" has been pleased to tell about himself, has prepossessed me much in his favor; and I hereby invite him to pay me a visit, when I will with much pleasure more fully satisfy him on the queries propounded.

In the mean time, I will say that the above essay is founded, *in the main*, upon practice, and not upon mere theory. I intended it as a practical illustration of my own mode in making and applying manures. If the piece has any merit at all, it is this latter feature which has given it its value. The only part of the essay which has not been carried into practice, and I think *successful* practice, by myself, is that which relates to manuring by confining cattle in moveable pens. For certain reasons, which it would be tedious to explain, I think it to my interest to keep but few cattle, only enough to consume the coarser offal of my corn. But were I more remote from market, I should certainly go largely into the cattle business, restricting the number only by the amount of food I could raise for them; and this I would do, in a great measure, for the large amount of manure they would enable me to make. Having then a large number of cattle, as soon as their shelters ceased to be necessary I would begin to pen them every night, and continue the practice, until the severe weather of winter would make it proper to collect them under their shelters again. How large these pens ought to be, and how long the cattle ought to be confined to one spot, must depend, as I state in the essay, on the number of cattle kept. In this way all the manure, both liquid and solid, would be collected; nor do I see why it should not be as permanent as when removed from the farm-pen. In my own case, I never confine my cattle, except on the farm-pen and in their shelters, and the sole reason is, that I have too few to make it an object to resort to moveable pens.

As to the inquiry about hogs, I would answer that the close confinement to which I subject mine is the result of necessity, not of choice. The same reasons which influence me to keep but few cattle, induce me also to confine my hogs. My farm is situated very near a good market, and is so small that I can allow no part of it as pasturage, either for cattle or hogs. Every foot of my land is constantly in some crop, either for home consumption or to be disposed of at market. Under these circumstances I resort to soiling, and in other respects make my stock as comfortable as I can. But it would add much to their thrift, if, in addition to their other care, I could allow them, particularly in warm weather, the indulgence of pasture, shade and running water. But notwithstanding these privations, I hesitate not to say, that under my care "they do thrive through our long, hot and dry summers," so that they are a source of considerable profit to me, and I see no reason why they should not be still more profitable to those who are in circumstances to allow them greater advantages.

The "labor necessary to collect materials for them to work up into manure" is, when properly fixed for it, not very considerable. The materials are fully explained in the essay. I will now add that they are collected in the winter, when work is not very pressing; after showers of rain when the ground is too wet to stir it, and at such other times as we find most convenient. Such opportunities are taken to store away large amounts, and then the labor of distribution is very trifling. This manure, though "mixed with large proportions of mud, dirt and litter," I consider as very valuable, particularly for corn, the great favorite of the hog. Its value would be much increased,

if to the mixture were added small quantities of lime, or larger quantities of ashes. I would not advise carrying it immediately to the field after removing it from the pen, but let it lie in heaps of 50 or even 100 bushels, until it becomes dry and comparatively light. In two or three months, and sometimes earlier, the vegetable matter will be pretty well decomposed, so that in digging into these heaps the whole will be found in a friable state, so as to crumble by the mere act of casting it into the cart. I now consider it as fit for use, and the next operation is to carry it to the field, where I find it of great service.

The next query is, "What will a farmer's pork cost him raised in this way, out of the immediate vicinity of a market?" To this I reply, that the cost of pork, either near to market or remote from it, depends very much on the following particulars: the price of corn, the thrift of the hog, the care that is taken of him, the quantity of food other than corn that is provided for him, and the constant economy with which he is fed, so that he will always have enough and waste nothing. My pork costs me, according to the best estimate I can make about $4 the 100 lbs.; and if the hog be a *thrifty* Berkshire—(and there is a great difference in the Berkshires,) about half that sum. In this estimate I take into the account the carcass of the hog and its cost in corn alone; for his extra food, care, &c., I consider as amply paid for by his manure.

But this subject is becoming irksome to me; not that I consider it unimportant, but simply because I have had occasion to write so much about it. I must therefore refer "A Young Farmer" and all others concerned, to a series of essays, which I wrote for the Southern Planter, and which appeared in that work in the volume for 1841. Mr. Charles T. Botts, the editor, will cheerfully (on forwarding to him a dollar) send the volume as directed.

"A Young Farmer" inquires, lastly, "What will it cost per acre to cut down the weeds, &c., for litter?" I answer, that in harvest mowers *here* also demand and receive one dollar per day. The usual task for a mower is one acre. But it is to be recollected, that the weeds are usually cut the latter part of September, or first of October, when the days are much shorter, and consequently the wages ought to be less. This work is commonly done by my own laborers, (for I sow no wheat,) and they do it immediately after gathering the fodder and cutting the tops. I once hired and paid 75 cents per day; but now I could get it done cheaper. But were the cost even greater, still I should feel myself amply compensated in collecting the weeds. I find they make the speediest, the richest, and the very best manure. The mules, the cattle, and even the hogs, eat them with avidity. In addition to this, there is a great convenience in having them stored away ready for use. In summer, when the crops are on hand, stables, hog-pens, &c., are often neglected, because we cannot spare time to send to the woods for litter; but here are the stalks of weeds which have been reserved for this very emergency, and it requires but little time in the morning or evening to distribute them. Thus, whilst the crops are busily engaged in exhausting the fields, the hogs, horses, &c. are as busy in manufacturing manure to repair the injury.

Connected with the above, there is one more inquiry still more important. "Is not the practice (of removing the weeds) injurious to the land from which they are taken?" This is very generally considered to be the fact, and at first view would seem to be the case. But after looking at the subject in all its bearings, I am decidedly of a different opinion. Now I do not pretend that the removal of a weed, or any thing else from the land, can benefit the spot on which it grew. But what do we accomplish by it? We produce an easy and convenient material, by which, even at the busiest seasons of the year, we can keep our stables and hog pens clean and healthy; and after answering this very important purpose, it answers another, if possible, still more important, it makes the richest and best manure. Then it cleanses the field, leaving it in a situation, in which the crop of young clover or other grass may make the greatest progress: and at the next harvest, instead of battering the scythe against hard dry weeds, there is a beautiful clean surface to cut over. Labor therefore is saved, and the crop secured is cleaner and in better condition. But what becomes of the weeds in the mean time? They are lost, it is true, to the spot from which they were taken, but they are not lost to the farm. After being charged with Liebig's ammonia, and other enriching properties, they are carried back to the field, and instead of *standing* here and there at intervals apart, or of *lying* thin, covering so large a space as to do almost no good, they are concentrated so as to display all their beneficial effects. And now I appeal to "A Young Farmer," and all others of equal candor, if weeds thus treated and used are not made to answer a more valuable purpose, than when left to injure the hay crop, or to fall and lie thin on the land?

And now having answered the inquiries of "A Young Farmer," whom, if he will allow me, I will call my friend, I must take a reluctant leave of him. But I hope to hear from him again over his own name. A mind so inquisitive as his cannot remain inactive, and when employed about farming, the first, the greatest and the best art, must lead to valuable results. But there is another correspondent in the same number (page 136) to whom it would be very uncivil and uncourteous in me to fail to pay my respects. And I take it as a very civil thing in the above correspondent, that he has had the candor to append his name to his communication. If Mr. Nicol will take the trouble to look to the end of this paper, he will also find my name there; and I now inform him, that the reason why the essay commented on by him appeared without a name was, not that I was ashamed of the piece, or wished its faults to be charged to another—not that I felt myself unable to sustain every position there taken, but simply for reasons which I shall not be at liberty to disclose till the meeting of our Agricultural Society, on the 25th day of May next. If Mr. Nicol will favor us with his company on that day, I will with much pleasure satisfy him on this point.

I proceed to consider this gentleman's strictures on my essay. "Passing, (says he,) over the preliminary observations of the writer I will begin with his stable management. I am not aware that any farmer or owner of a horse, who

pays a due regard to his own interest, the health and comfort of his horse, or to the most economical mode of making manure from that source, is in any doubt as to how long this (stable) litter ought to accumulate before it is removed; and that is, that it should be removed every day. The writer of the essay is, however, "of the opinion that it ought to remain until by its great heat it endangers the health of the animal." On this, I remark, that in the above sentence, I have been very unfortunate. I labor under the misfortune of not being understood. Now I acknowledge that it is one of the first requisites of a writer or speaker to make himself understood. In this instance, however, I am so unfortunate as to have failed. At this, I confess, I am a little surprised; for I used neither Latin, nor Greek, nor Hebrew, nor any other dead language, but the plain *living* English, and that too of the simplest kind; and yet Mr. Nicol has failed to understand me? He seems to think that the danger in the case must necessarily go so far as actually to *produce* the apprehended evil. Now I never intended to convey any such idea, and I did suppose that I had sufficiently guarded against any such construction, by what appears in the sequel. I intended that the litter should accumulate, and the decomposition go on, until the point of danger was reached, and then arrest it, by removing the whole mass. In the case of my "stable management," we will suppose that the heat increases, until a careful vigilant master sees that the apprehended danger will soon issue in the evil which he wishes to prevent, and promptly takes measures to arrest it; what misfortune, let me ask, can ensue in this event? Danger was *incurred*, it is true, but a timely preventive was administered, and therefore no evil ensued. But what is the object of supplying a stable with litter? It is, according to my theory, two-fold, first, to promote cleanliness, and second to increase the amount of manure. And now the whole matter is narrowed down to this one point. By what management can manure be most rapidly increased? Is it, by daily throwing it out in small quantities, as Mr. Nicol supposes every body does, there to be evaporated by the sun, or washed away by the rains, or torn to pieces by the hogs? Or if the hogs will let it alone, till it accumulates to a large amount, still to let it remain there, until full one half its virtues are destroyed by fire-fang? Or is it, to let it lie in the stable as I recommend, and, as I think, common sense recommends, safe from the sun, from the rains, from the hogs and fire-fang, until the health of the horse begins to be in danger, and then immediately remove it for use?

But on Mr. Nicol's plan, permit me to inquire, what becomes of the *liquids*, which according to late scientific authority is the very best part of manure. According to Liebig, who by the best farmers of England and America is now received as a standard authority in scientific agriculture, it is the ammonia which gives its chief value to manure, and this property is derived mostly from the urine. But from any thing that appears in his strictures, Mr. Nicol lets the whole of this run to waste. There is no litter to absorb it, for it is all thrown out every day, nor is there any cistern or tank to collect it. This important article, then, imparting its chief value to manure, is, according to this wasteful farmer's plan, wholly lost. No wonder then (see page 99) he had to apply such very large quantities of marl, and of burned shells, to keep up the fertility of his land. Any man who will submit to such a waste at home, must resort to a large amount of foreign material to supply the deficiency. In my stable, I am happy to say, there is no such waste. The liquids are collected, and the solids are preserved; and this is done, whilst the health of the animals is carefully preserved.

I am truly sorry that my mode of pen-feeding cattle, comes also under the ban. To this plan, Mr. Nicol objects, because he "has never yet been able to secure that amount of cleanliness so desirable to the health and comfort of the animals so fed." As a set-off to this, I remark, that I have never been able to secure health and cleanliness on any other plan. This very season, I wished to make a beef of one of my steers, and that he might enjoy every advantage, I confined him to a stall. I gave him frequent supplies of litter, and at length was compelled to adopt Mr. Nicol's mode of daily throwing it out; but still every morning one flank and thigh of the poor beast was comepletely covered with his own filth. Whilst this was the case, the cattle that lodged in the pen, or selected their own place under the shelter, were quite clean. Besides, if Mr. Nicol will favor me with a visit, and I should be very happy to see him, I will show him what it seems is a stranger to him, a *clean* farm-pen. But fearing that he will not accept my invitation, I will tell him what sort of a farm-pen I have. It is situated on a gentle declivity, with a bank on the lower side, and through this bank is an aperture, which I can open or shut at pleasure. By shutting I retain the fluids, and by opening I can discharge them, when they become excessive. Now by this contrivance, and by what I speak of in my essay, large supplies of litter, (I mean large for a small farm,) I actually have a clean and comfortable farm-pen; and if Mr. Nicol will fix his farm pen in the same way, I venture to say that he will have cleaner and better contented cattle than he now has, when confined to their stalls.

But he also reads me a lesson about my hogs, and thinks my mode "of feeding will not suit the judicious hog breeder." When I came to this sentence, I was at once fully convinced that Mr. Nicol did not know against whom he was hurling his shafts. Why, sir, the hog business is my strong forte. If I excel in any thing, it is the skill with which I manage my hog department. My piggery with its inmates is the admiration of the whole country. It is well worth a trip from Sandy Point to visit it. I have just sold a fine young Berkshire boar just eight months old for $55, a pretty good price for a small farmer these hard times. I still have fine boars and brood sows, and thrifty shoats, and promising pigs. One word more; my neighbors will *laugh* at Mr. Nicol if he attempt to give me any more lessons about breeding hogs. With these remarks I dismiss all that he says about my hog-management.

But, as it appears to me, he is a little anxious to turn me into ridicule. Hence (page 137) he says, "I would ask the writer, when is manure thoroughly, properly, fairly, fully made?" Now I was not aware, till I saw all this array of epithets brought together, that I had made use of

one half of them. I must have had a kind of presentiment that I was writing for just such a person as Mr. Nicol implies himself to be, one who finds it difficult to comprehend. For to show what I meant by manure fully made, I unconsciously used no less than four different epithets all pointing to the same thing. Hitherto I have taken to myself no credit for any thing except my hog-management. Now, I begin to think, I deserve some credit for my ingenuity in avoiding the figure of speech called tautology, which is so offensive to every correct writer; for the terms thoroughly, properly, fairly, fully, though they *point* to the same thing, do not *mean* precisely the same thing. Now I will venture to say, that there is no farmer, great or small, young or old, who honored my essay with a perusal, but fully, thoroughly, fairly, properly understood its meaning—Mr. Nicol always excepted. But I really wish to enlighten him also. I shall begin to think much less favorably of myself as a writer if there be a single reader who does not *fully* (I beg pardon for using this word) understand me. I will again look over his piece, and see if I can find an easier term. I see he uses frequently the word "decompose." I will employ this, and see if I can make my meaning clear. By manure fully, &c., made, I mean vegetable matter which when mixed with animal excrement has undergone decomposition, so that the vegetable fibre is destroyed, and is reduced to a state of rottenness. When I find vegetable matter of any kind, leaves from the woods, wheat straw, corn stalks, weeds from the field, or any thing else in this state, I call it manure; and I consider it so valuable that I wish I had thousands of it on my little farm at this time.

But I am again incurring my common fault, making my paper too long. There is however one more point or which I must pay my respects to Mr. Nicol. At the close of his strictures, he says, "I have seen finely rotted manure, dry straw from the stack, and dry and recent leaves from the woods, applied to clover side by side, and the best results were from the covering of dry straw. I have also seen young wheat top-dressed with pine leaves (on marled land) with benefits, though of course less in degree, as distinctly marked as I have ever seen from the application of rotted stable and farm-pen manure." Now, let it be understood, that in commenting on and objecting to the above passage, I do not call in question a single fact there expressed; nor do I doubt that the writer firmly believes all he states. But does he mean that "dry straw from the stack and dry and recent leaves from the woods," remaining and continuing dry, will have a better effect on clover, than will rotted manure? I do not wish to do the writer the slightest injustice, but this really seems to be his meaning. The straw and leaves, it is true, were dry when applied, but they soon became wet, and the young clover having itself a great attraction for moisture, soon covered them, so as to screen them from the evaporation of the sun, and thus, being in a state of continual moisture, they underwent a rapid decomposition. In this process the gases were evolved just in the position and at the time to benefit the clover. Whilst this was the case, the rotted manure, made on the wasteful plan of Mr. Nicol, deprived of its valuable properties, remained there almost in an inert state; and this is the real reason why his straw and leaves produced a more beneficial result than his rotted manure.

There are some other matters on which I intended to comment, but this must do for the present. Whether I shall take them up hereafter depends on circumstances. J. H. TURNER.

ANOTHER MODE OF KEEPING SWEET POTATOES.

To the Editor of the Farmers' Register.

Prince George county, Va., April 8, 1842.

Having made an experiment in keeping sweet potatoes which has proved highly satisfactory, I think it might be advantageous to many of your numerous readers if they would adopt my plan, which is this, viz.: I selected a dry spot, around which no water would remain, and had the sills of my house (ten feet square) placed flat on the ground. I then had the earth dug out to the depth of 2½ feet, and as the earth was thrown out I had it thrown around the sills so as to raise it to a level with the top of them, and sloped off gradually, to turn the rain water falling from the eaves entirely away from the house. I then had the rafters, 2 by 6, nailed to the sills, and the gable end studs, also 2 by 6, fitted from the sills to the rafters; and the whole closely planked on the inside, and as the outside planks were nailed on I had the space between (which of course was six inches) filled in with earth, so that the air was entirely excluded, except at the door. I had two doors made, one to hang on the inside, and the other on the outside, so as to fill in between them with straw or pine leaves, if the winter should be very severe; but I used only the outside door, the winter having been so mild.

When I put my potatoes away, I had some old slabs placed at the bottom of the house, and then a layer of pine leaves, on which I put the potatoes, and after they were all put in, I had them covered thickly with pine leaves.

The eating roots were separated from the plantings, so that we might go in at any time, and get such as were wanted. They were put away on the day they were dug, and we got out such as were put away for eating, every day until some time in February, at which time the eating roots were all used, and I do not think one peck had rotted, out of about 30 or 35 bushels.

The plantings (which I took out a few days ago) also kept remarkably well. The only rotten ones which I saw seemed to be around the edges, where the mice had burrowed under the sills, and caused the dirt to fall in upon them. The mice were quite destructive to them in consequence of having no underpinning and floor, by which they may be effectually excluded.

I had one barrel filled with a particular kind, which I wished to keep separate from the others, and in this barrel I saw scarcely one rotten potato, although the mice had eaten nearly one third of them.

As this was only an experiment, I would not incur the expense of underpinning, &c.; but as the result has proved so satisfactory, I intend to have the house underpinned, and a brick floor laid in

strong mortar, to prevent the mice from getting in.

I have no doubt that saw-dust would be preferable to earth for filling in between the rafters, &c., as the timbers would be less liable to rot, and the saw-dust, (if packed in closely,) would as effectually exclude the air, and at the same time have a tendency to absorb any moisture arising from the potatoes in going through a sweat.

The greatest advantage in this plan is that you may get your potatoes to use just when you please, without the fear of having them injured, except in the severest weather in winter, during which time I think it might prove injurious to open the door at all, except in the warmest part of the day.

J. H. Battle.

OF MIXED EARTHS AND CREEK MUD.

From the Transactions of the Society for Promoting Agriculture in the State of Connecticut.

What experiments have been made of creek or harbor mud from the sea flats? what of mud taken from fresh-water ponds? what of the soil taken from swamps overflowed? How have they been used? on what soils, for what crops, for what grasses, in what manner, in what quantities, and what advantage has been derived from them?

Mr. Belden, of Wethersfield. A piece of land in my neighborhood was manured with earth that had been leached to make saltpetre—the earth had been leached ten years before—the land has borne surprising crops ever since this earth has been applied. I have never witnessed so great and lasting effects from any species of manure.

Mr. Hart, of Berlin. One of my neighbors carried on to his upland mowing a number of loads of earth from under an old barn. It has improved his land surprisingly. For several years the crop has been very great.

Mr. Abel Bronson of Waterbury. I have tried the earth, taken from the ditches in my meadows, but never found that my land received any benefit. I have carried large quantities into my hog sty and barn yard, in autumn, and in the spring have manured my Indian corn with it. I have found a load of this mixture of the earth and manures, as beneficial as a load of unmixed manure, from the barn yard or the sty. I have used the mixture, when it has lain in this situation a year, and never found any dung better.

Of yard or stable dung—tanner's bark, &c.

What methods have been taken to augment the manures taken from the yard or stable? What means have been found to succeed best for that purpose?

Mr. Andrew Hull, Jr., of Cheshire. I have found no manure so beneficial, on poor land, for potatoes, as the droppings of the cattle intermixed with straw, thrown into the yard to make manure, even before it is matured.

Mr. Abel Bronson, of Waterbury. I have thrown pumice, tanner's bark, &c., into my hog sty, and found them to become very good manure.

Mr. Blakesley of Plymouth. More than twenty years past, I had a large nursery of fruit trees. To prevent weeds, &c., from growing, I covered the ground over with tanner's bark. It prevented every thing but the trees from growing. After some years had elapsed, when the trees had all been taken from the nursery, I sowed the land with oats and clover. The oats were good, and the clover excellent. Since the clover has gone out, the natural grass has come in, and the land has continued as good as any I have. I have found bark one of the best kinds of manure.*

I find, from experiment, that two loads of dung, carried on the land in the spring, are worth three loads carried on in the fall.

Ploughing in of clover, or buckwheat.

Have any experiments been made of manuring land with clover, buckwheat, or oats turned, or ploughed into the earth before they were ripe; and has any benefit been received?

Mr. Hart, of Berlin. I have made an experiment in ploughing up a field, on which I had two years before sown clover. The clover was mowed and yielded a good crop. Soon afterwards I ploughed the field and let it lie until I found that the clover had matured. I then ploughed it again. The land looked very well, and I supposed it much enriched. I sowed wheat, but was disappointed in it, for the crop was poor. I knew, however, that the land was much enriched, and concluded that I was prevented from having a good crop of wheat from other causes than the land not being well prepared.

Mr. Phelps, of Simsbury. I ploughed up a clover field, the second year after it was sown, when the roots were full grown. It was about a fortnight after mowing the land. I let the field lie in this situation about six weeks, then harrowed it well—sowed it with wheat, and ploughed in the wheat. The next year I harvested as much as twenty bushels to the acre. The soil was rather dry and sandy.

Mr. Hooker, of Farmington. I sowed a sandy field with buckwheat. When it was grown and in bloom, I ploughed my field in ridges, and covered the wheat. After it had lain about six weeks, I ploughed it again in ridges, putting the new ridges where the balks were before. Soon after I harrowed the field, and sowed it with wheat. The next summer I harvested an excellent crop.

Mr. Belden, of Wethersfield. I have sown buckwheat, both on sandy land and on loamy land, and ploughed it in to prepare the land for wheat. I have had good crops from it, and have found the experiment to succeed to my wishes.

SUGAR FROM CORN STALKS.

Extract from an editoral article of the New Genesee Farmer.

Another great article of product spoken of in the report,† is that of sugar from corn stalks. "A new mode of raising corn, trebles the saccharine quality of the stalk." This is certainly an extraordinary discovery. The stalks of corn, if

* Tan bark is injurious to soil before it rots; then it is excellent.—Ed. Gaz.

† Of the Commissioner of Patents.

gathered before the ear is formed, it is here stated, yield of saccharine matter three times as much as the beet, five times as much as the maple, and fully equal, if they do not exceed, that of the ordinary sugar cane in the United States. "One thousand pounds of sugar, it is believed, can *easily* be produced from an acre of corn. It has been ascertained, by trial, that corn on being sown broad cast [and so requiring but little labor, comparatively, in its cultivation,] will produce five pounds per square foot, *equal to* 108 *tons to the acre for fodder in a green state*; and it is *highly probable* that when subjected to the treatment necessary to prepare the stalks, as above described, in the best manner for the manufacture of sugar, a not less amount of crop may be produced. Should this prove to be the case, *one thousand weight of sugar per acre, might be far too low an estimate.* Should the manufacture of sugar from the corn stalks prove as successful as it now promises, enough might soon be produced to supply our home consumption, towards which, as has been mentioned, at least 120 millions of pounds of foreign sugar are annually imported, and a surplus might be had for exportation."

These statements may well be called startling; but we must be pardoned if we consider them, in some measure, of the *multicaulis* variety. We have a high respect for Mr. Ellsworth; we believe there is not a better officer in the government; and that no man living would be more reluctant to make a misstatement than himself. But we want a good many more facts and experiments in the case, before we can yield entire confidence to such predictions. The whole, for aught that appears, grows out of a statement of a Mr. Webb, of Delaware, given in our November number, who obtained from a small piece of ground at the rate of 100 lbs. of sugar to an acre, and who states that further experiments showed conclusively that the produce *might* be increased ten-fold. Now we have no desire to question Mr. Webb's veracity; but it will be observed in the first place, that he has not yet obtained 100 lbs. to an acre, but only at that rate; and in the second place, that although experiments to him have conclusively shown that a thousand pounds may be obtained to an acre, yet we do not know what those experiments were, and the conclusion is matter of inference or private judgment. We shall be exceedingly glad to be set right on this subject.

The calculation of producing green corn fodder at the rate of 108 tons to an acre is, we believe, more easily asserted than proved. We should like facts in this case much better than conjecture.

Tall meadow oat grass has yielded, green, at the rate of 16,335 lbs. per acre, and dried, 5717 lbs. Millet has yielded, green, at the rate of 12,251 lbs. per acre, and when dried, 4747 lbs. Herdsgrass, when green, 40,837 lbs., and dried, 17,355 lbs., or when cut after the seed is ripe, 19,397 lbs. A crop of herdsgrass producing when cured 17,355 lbs., is indeed enormous; and what very few among us have ever seen, less than five tons being the largest measured crop which has come within our knowledge. We have never known a crop of green corn fodder weighed, when cut for fodder, but we have given in our last No. the weight of an acre of corn fodder of the gourd seed variety, when cured, including husks, and yielding 66 bushels of grain per acre, and the whole amount of that was 2 tons, 13 cwt., 13 lbs. In the case of herdsgrass, the proportion of green weight bore to the dried as 40 to 17 or as 20 to 8 tons. If we may infer any thing from this fact in regard to Indian corn, we may reckon the green fodder from such a yield of corn as 6 to 7 tons. It would, however, be much more than this, if the corn had been sown broadcast; and perhaps may be quadrupled. Conjecture, however, is idle in a case where, we hope, we may soon have facts. It is supposed in the case of the report, that the corn is to be sowed broad cast and yield at the rate of five pounds to a square foot. This is a remarkable calculation; and if corn is sowed thus thickly, how is it to be got at to pluck off the ears, which is said to be a necessary part of the process? A few months however, will settle this; and if an acre of corn, by the mode described or any other mode, can be made to yield five hundred pounds of sugar, we shall throw our hats up as high as any one in the crowd.*

SOMETHING ABOUT WESTERN PRAIRIES.

By Solon Robinson.

Extract from the American Agriculturist.

I am sorry that I am not able to answer the second question, even satisfactorily to myself. But who that ever undertook, ever satisfied his inquirers as to how a prairie looks, while in a state of nature. The reason is that there is nothing analogous, to which one can compare it, in a thickly settled country. But suppose that the reader fancies the country with which he is best acquainted in an old settled country, entirely destitute of buildings or fences, or in fact any mark of civilization, with all the hills reduced so as to make a gently rolling surface, the woodland to remain as it is, and the entire surface of cleared land covered with grass—that upon the upland thick and short, and in the low lands one or two feet high, and in the swamps four or five feet, and he may have a very faint idea *how a prairie looks.*

So you see they are not so "very level." Gently undulating, applies to all prairie countries within my knowledge. Sometimes, though rarely, hills occur that are too steep to cultivate conveniently, and sometimes rocky bluffs. But a general characteristic in this region is destituteness of stone, except a few boulders of granite, that have come from parts unknown.

The streams are most generally muddy bottoms. The timber in the groves or islands that abound throughout this sea of grass, is most commonly short, and grows thin upon the ground,

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* Since penning the above, we have seen it stated in some exchange paper, that forty tons of green corn fodder were obtained from an acre in Worcester Co. Mass.; and at a late agricultural meeting in Boston, the editor of the New England Farmer is reported in the Ploughman to have said that he understood that 100 tons of green corn had been cut from a single acre at three cuttings, in a season, and he had known 37 tons cut on an acre at one time.

We have no disposition to impugn these statements in the smallest measure; but we should be exceedingly glad to know when and where these crops were produced; and how and when the amount was ascertained.

without underbrush, except at the edges, where the hazel bush seems to be the advanced guard, and is constantly encroaching upon the prairie. There are large tracts of timber land called "barrens," which are about half way between prairie and timber land—the tree standing apart like an orchard, and the ground covered with grass, the sod of which is much less tough than that on the prairie.

One very prominent feature of a prairie, I should mention, and that is the constant and ever varying succession of flowers from spring till fall.

A singular and false notion prevails about the height of the grass, and that it must be difficult getting about. It is not even difficult for a sheep, as the grass never grows high enough upon the dry land to impede or hide them. Near the banks of streams, or in marshes, it is like going through a field of oats or wheat. And it is in such places that grass is cut for hay—some very good—some good—and some that the less said about the smaller the sin committed.

But as for pasturage, no country can excel this. The milk, butter, cheese and beef attest the rich juiciness of the feed. But we lack the beautiful blue grass pastures of Kentucky, for fall feed. Even now, near the middle of December, notwithstanding we have had a hard fall for this country, this grass is green and good. Even timothy or red top would yet afford "a good bite."

The next wonder is about ploughing. And if, my dear reader, you who have ploughed so many acres of greensward with old "Duke & Darby," could only see a "prairie team," you would wonder still more.

Fancy upon a level smooth piece of ground, free from sticks, stumps and stones, a team of four, five, or even six yoke of oxen, hitched to a pair of cart wheels, and to them hitched a plough with a beam fourteen feet long, and the share, &c., of which weigh from sixty to one hundred and twenty-five pounds, of wrought iron and steel, and which cuts a furrow from sixteen to twenty-four inches wide, and you will figure the appearance of a "breaking team" in operation. If you ask me if this is necessary, I can only tell you that I suppose it is, for it is *fashionable*.

I do believe though, that a smaller plough and less team would be better for the land, though it is said it would be more expensive ploughing. It is true that the sod is more tough than can be believed by those who have never ploughed it. It requires the plough to be kept very sharp, and for this purpose the ploughman is always provided with a large file with which he keeps a keen edge as possible upon the share and coulter.

Such a team ploughs from one to two acres a day, usually about four inches deep, which is not near down to the bottom of the roots, so that the sod turned up affords but a scanty covering for grain that is sowed upon it at first, yet, very fine crops of wheat are raised in this way. It is also a common practice to break up in the spring and drop corn in every second or third furrow, and from which twenty or thirty bushels to the acre are often gathered, nothing having ever been done to it after planting. It takes two or three years for these sods to become thoroughly decomposed, and then the soil is of a light, loose, black vegetable mould, very easily stirred by the plough, but of a nature that it adheres to the plough in a troublesome manner. In fact, no plough has ever been found to keep itself clear; and the ploughman is generally obliged to carry with him a small wooden paddle, with which to clear off the adhering mass of dirt upon the mould board. With this exception, the prairie soil is generally one of the easiest in the world to till, and of course remarkably fertile.

By far the greatest portion is based upon a subsoil of clay, though in many places the subsoil is sand or gravel, and there are large tracts of which the surface is of this material. The streams are often broad and nearly covered with vegetable growth, in some instances to that degree that sheets of water many rods wide actually burn over during the autumnal fires.

Notwithstanding the many "interesting accounts of burning prairies," the fire upon a dry prairie in a calm time does not blaze as high as it would in an old stubble field. But in the marshes or wet prairies, it sometimes rages with most magnificent grandeur.

MARLING IN SOUTH CAROLINA.

Extracts from an Address to the Pee Dee Agricultural Society, by Dr. M. McLean.

There is another source of fertilization accessible to the planters, on and near the Pee Dee, which I can now only name. I mean the limestone and marl which are found in quantities inexhaustible on the very banks of the river. The subject is almost new to many of us, and one in which we are deeply interested. If time allowed I would dwell at some length upon it. Those who wish information in regard to it, are referred to the Farmers' Register, and the valuable Essay on Calcareous Manures, by the able editor of that excellent periodical; a work which ought to be in the hands of every member of this society, and every planter on the river.

Before closing I shall state an experiment made last season with the Pee Dee marl, by a Mr. Cunningham of Marion, on whose land a bed of it is found. It was spread at the rate of 200 bushels to the acre, on part of an old field of sandy soil, which had once been exhausted, and then suffered to lie out till it became covered with a growth of young pines. The marl was applied the second year after the land had been recleared, and the crop planted was Indian corn. Upon measuring the crop after it was gathered, the yield was found to be exactly double that of adjoining land of the same quality, planted at the same time and cultivated in the same way. This information I received from a gentleman of intelligence and respectability, who saw the crop growing, and saw the corn measured when it was gathered. Not knowing that I should use the information in this way, it did not occur to me to inquire what was the yield to the acre; but my informant stated that the growth was very luxuriant, that the number of stalks in the hill was two; that the corn succored freely, and that on some hills he counted as many as seven good ears, some of them on succors.

Lime can be delivered on the banks of the river, not far from Marr's bluff, at one dollar per barrel; and at a less price, if the purchasers furnish boxes in which to receive it. Marl can be shoveled from the bank into flats or boats lying in the river; and according to the best information which I have been able to collect, it may be delivered on the river bank at this place, at a price not exceeding 5 cents per bushel. Now, supposing 200 bushels of marl per acre, to double the planters crop, without increasing his labor of cultivation, whether, in that case, it would be a profitable operation for him to purchase it at that price, haul it to his plantation and spread it out, is a matter of calculation which every one may make for himself, in his own circumstances. The fertility imparted to soil by lime is more durable than that imparted by perhaps any other manure. The effect of its application to lands in Virginia, 50 and 60 years ago, are yet manifest, by the superiority of the crops produced by these lands, compared with those produced by adjoining lands. Lime seems to effect a permanent amelioration in the texture and qualities of the soil.

NO GUESSING—CUTTING OF HAY.

From the New England Farmer.

Mr. Editor—Much has been said and written upon the advantages of cutting fodder for cattle. I have frequently heard it said that to cut the feed for cattle, was a saving in the amount eaten of from 20 to 30 pounds to the hundred. An assertion to this amount, I not very long since read in your valuable paper. It appears to me some men *live for the sake of farming*, while others farm for the *sake of a living*. I get my bread by the sweat of my face, and have long since learned to receive cautiously the views of those who give experiments to the public from what "*my man*" says. I never was persuaded to be at the expense of cutting fodder for my stock, until the past winter. In the early part of last winter I purchased one of Green's machines for cutting straw and hay. After having learned my cattle to eat cut feed, (for I was obliged to learn them,) I commenced what I considered an experiment that would prove the loss or gain of cutting fodder. I weighed, cut and fed myself, with the exception of three or four days, when ill health prevented. And now if you think my experiment will be of use to my brother farmers, you may give it a place in the N. E. Farmer.

In 1840 I was unfortunate, and nearly lost my grass seed by the drought, so that in 1841, my crop was full half sorrel mixed with clover. Upon this hay I fed my cows, with the addition of now and then a foddering of corn stover. I commenced with two cows, the 29th of January, giving them all they would eat for seven days; at the end of which I found I had given them 270 lbs. All that remained of what I had given them, and which they refused to eat, was 3 lbs. Actually consumed, 267 lbs.

I then fed without cutting for seven days. At the expiration of this time, I found I had given them 290 lbs.; and there remained of what they refused to eat, 30 lbs. Actually consumed, 260 lbs.

I then put two cows more with those above referred to, and fed them on fine hay and herdsgrass for seven days, without cutting, and found there had been given them 491 lbs. There remained which they refused to eat, 45 lbs. Consumed, 446 lbs.

I then put them seven days on the same hay cut and mixed, and found I had given them 454 lbs. There remained of that which they refused to eat, 20 lbs. Consumed, 434 lbs.

It will be seen that in the last case, 37 lbs. more was given to the four cows of uncut hay, and 16 lbs. more was eaten than of that which was cut. This I account for in the change from the poorer to the better hay. Had the good hay been given first cut and then whole, the difference would have been the other way, in all probability; for the two weeks succeeding, they consumed a few pounds more of cut than of whole hay.

Perhaps you may suppose that by this time, my hay cutting machine is stowed safely away in some back corner, as lost and useless. But this is not the case. But I am thoroughly convinced that there is no saving in the quantity of hay by cutting. Nor do I believe that good clean hay pays the expense of cutting for any stock, unless it be for a horse. But coarse clover and coarse meadow hay pay well for cutting because cattle will eat *more* not *less*. I have cut and mixed these two kinds of hay, and if the condition of my cattle may be admitted as evidence of the benefit of cutting such hay, it is proved to my satisfaction. Yours, respectfully, OTIS BRIGHAM.

Westboro', 24th March, 1842.

☞ Mr. Brigham is worthy of all confidence. He has here given very valuable statements. The facts surprise us. We had supposed that there was more actual saving from cutting food for our cattle—but the statements of the scales must be taken;—a single tale from them is worth a thousand guesses. In one important respect this trial is deficient: the *time is not long enough*. To show that other trials have resulted differently, we copy the following statement:

"*Mr. Benjamin Hale's account of the saving made by the use of straw cutters, employed to cut hay and straw, as fodder for horses.*

Mr. Hale was proprietor of a line of stages running between Newburyport and Boston. He says:

	T.	*cwt.*	*qr.*	*lb.*	
The whole amount of hay purchased from April 1 to Oct. 1, 1816, (6 months,) and used at the stage stable, was - - - -	32	4	0	10	
At $25 per ton, (the lowest price at which hay was purchased in 1816,) -					$800 00
From Oct. 1, 1816, to April 1, 1817, whole amount of hay and straw purchased for, and consumed by the same number of horses, viz: - - - -					
Straw, *T.* 1 13 3 10					$160 23
Hay, 13 14 1 00					350 00
					$510 23
Deduct on hand April 1, 1817 by estimation four tons more than there was Oct. 1, 1816, at $25 per ton,					$100 00—410 23
Saving by the use of the					

straw cutter, four months of the last six months, or the difference in expese in feeding with cut fodder and that which is uncut, $389 77

Mr. Colman, if we are not mistaken, has somewhere given an experiment for three months, by which he made the saving 50 per cent. or more. —*Ed. N. E. Farm.*

ROLLING WHEAT IN THE SPRING.

From the New Genesee Farmer.

Mr. Colman—It is evident that much of the wheat through the country, especially on moist mucky lands, is injured by the frequent freezing and thawing during the past winter. Unless something can be done to remedy the evil, to some extent, we have to fear quite a failure in the coming crop.

Farmers may say that they have done all that they can do to secure a crop; but there is one thing which, if done in season, may effect a great saving. Let every farmer who has not one, provide himself with a good roller, and as soon as the season of freezing and thawing is over, roll his wheat fields thoroughly, and I have no doubt that it would save thousands of bushels of wheat in Western New York, the present season. Farmers! try it, leaving a part of a field unrolled, and give to the community the result of your experience at some future time. M. N.

Genesee Co., March, 1842.

Editoral Remarks.—Rolling and Harrowing Wheat.—The above advice is seasonable, and, we have no doubt, judicious. We should recommend something more than rolling; and that is, harrowing before rolling. As soon as the land is well dried, give your wheat fields a good harrowing, by passing over them with a horse harrow or one not too heavy; then roll them. In a fortnight or three weeks more go over them again with a harrow and a roller. Do not be afraid of destroying your wheat. Unless your harrowing is too heavy you will not displace or pull up many plants; and the advantages which those which remain will derive from the operation, will be a full compensation for any loss in this way. We have fully tested this matter more than once, having harrowed our wheat crops twice in a season, and after the plant was eight or ten inches in height; and with decided advantage, having left in such cases parts of the field untouched with a view to determine the expediency or inexpediency of the operation. The result has been highly beneficial. The effect of it is, by stirring the ground, to bring the air to the roots of the plant, and to loosen the soil so that they may extend themselves freely. This induces a vigorous vegetation, and causes the plant to tiller abundantly and throw out numerous shoots from the crown. We advise to harrow only in one direction. The rolling will serve to break the clods and to fix the plants, which are thrown up, in the ground. In England, wheat is frequently sown in drills with a machine adapted to the purpose; and afterwards cultivated by a cultivator, contrived to pass through and loosen the soil in the rows, as we plough and cultivate between the rows of our Indian corn. This is said always to be beneficial to the crop, though with our imperfect means such refined tillage can hardly be looked for, and, with prices of labor among us, might not be compensated.

We have yet to learn the value of constant tillage to the growing plant; and believe it would be found of the highest importance to our Indian corn to plough and cultivate it much more than we do. These suggestions coincide with the true philosophy of vegetation as far as it is understood, as such tillage causes a discharge of ammonia from the decaying vegetable matter in the soil, and quickens the receptive powers of the roots and leaves of the plant to take it in.—[Ed. N. G. F.]

ERRATA.—The article "On the different schemes of rotations," p. 175, was printed during the absence of the editor, which caused some typographical errors to appear, which otherwise would have been corrected. The only one, however, which affects the sense, is the word "*corn*," in line 23, col. 2, p. 176, which is a misprint for "come" in the manuscript. The reader will please mark the correction.

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THE FARMERS' REGISTER.

VOL. X. MAY 31, 1842. No. 5.

EDMUND RUFFIN, EDITOR AND PROPRIETOR.

IRRIGATION.

From the Farmer's Encyclopædia.

In agriculture, the watering of the earth, to increase its productiveness. The term, however, is confined to that species of flooding which consists of spreading a sheet of water over a field or meadow, in such a manner that it can be easily withdrawn.

Irrigation, or the artificial watering of the earth, chiefly to produce increased crops of grass, has been in use from a very early period. In Oriental countries, in fact, the heat, of the climate is such, that, in many situations, the now productive soil would be absolutely sterile, were it not that the cultivator enriches his ground with a copious supply of water. The simile employed by Isaiah, (i. 30.), to indicate barenness and desolation, is "a garden that hath no water." And that, in patriarchal times, they labored hard to supply their grounds with water, by means of various hydraulic machines, some of which resembled the water-wheels of the fen districts of England, and were worked by the feet of men, something after the style of the modern tread-mill, is certain. Moses alluded to this practice when he reminded the Israelities of their sowing their corn in Egypt, and watering it with their feet (*Deut.* xi. 10; 2 *Kings* xix. 24,) and in the sandy soils of Arabia the same system is still continued (*Niebuhr*, vol. i. p. 121). According to Dr. Shaw, the following is the modern mode of raising and using the water of the Nile for the purpose of irrigation in Egypt: "Such vegetable productions as require more moisture than what is occasioned by the annual inundation of the Nile, are refreshed by water that is drawn at certain times out of the river, and lodged in large cisterns made for that purpose. The screw of Archimedes seems to have been the instrument formerly made use of for that purpose, through at present the inhabitants either supply themselves with various kinds of leathern buckets or else with a *sakiah*, as they call the Persian wheel, which is the most useful and generally employed machine. Engines and contrivances of both these kinds are placed all along the banks of the Nile, from the sea to the cataracts, their situations being higher, and consequently the difficulty of raising the water being greater, as we advance up the river. When their pulse, saffron, melons, sugar-cane, &c. (all of which are commonly planted in rills,) require to be refreshed, they take out a plug from the bottom of the cistern, and then the water gushing out is conducted from one rill to another by the gardener, who is always ready, as occasions requires, to stop and divert the current." In Egypt at the present day, according to Dr. Clarke, the water is sometimes raised, for the purposes of irrigation, by means of a wicker basket, lined with leather, which is held by cords between two men, who, by this laborious means, swing it over the banks of the Nile into the canal which conveys it to the lands intended to be irrigated. A machine similar to the Persian wheel is still employed in China by the cultivators, for the purposes of irrigation. This use of machinery for the purposes of watering might in fact, in many situations, be advantageously employed in England, to a much greater extent than is commonly believed. It is well known how many thousand acres of valuable land are profitably drained by means of the steam-engine. At this very period a public company is proposing to enclose and drain an arm of the sea in Lincolnshire, by the assistance of its gigantic aid. Yet how rarely, if ever, is that power employed to irrigate the thirsty lands of England; lands of all others the most profitable, the best adapted for the formation of water meadows? The tracts to which I allude are those on a slope, as on a side of a hill; but these are rarely found in situations where a sufficiently copious supply of water can be constantly obtained for the purposes of irrigation. Yet the quantity thus required is not so large as to be beyond the power of the steam-engine to supply; thus, to sufficiently saturate a square yard of a calcareous sand soil with water to the depth of one foot, as in irrigation, requires about 30 gallons of water, equal to about 145,000 gallons per imperial acre. Now, that the steam-engine could readily and profitably supply this quantity of water, may be concluded from several facts; thus, the two engines, one of eighty, the other of sixty horses' power, which keep Deeping Fen, near Spalding, completely drained, when working, in 1835, only ninety-six days, of twelve hours each, raised more than 14,000,000 *tons* of water several feet. The district drained by them contains about 25 000 acres (*Brit. Farm. Mag. N. S.* vol. iii. p. 300), which would otherwise be a complete swamp. And it has been proved that by a common condensing steam-engine, one bushel of coals would raise more than 50,000,000 lbs. of water one foot. In many situations, therefore, where, for the purposes of irrigation, good river water can be copiously obtained, and fuel is at a moderate price, I am confident that great results are yet to be obtained by the aid of mechanical power. For, by the steam-engine, the soils of all others the best adapted for irrigation may be successfully brought into cultivation; for instance, the poor sands and gravels on the sloping banks of many of the English and Scottish rivers, many of whose waters, from being charged with organic matter, the carbonate and sulphate of lime, and various earthy substances, are excellent for the use of water meadows. The early employment of irrigation by the Egyptians and Chinese was most likely the result of the good effects which were observed to be produced by the overflowings of the Nile and the Chinese rivers; for in the "Celestial Empire," irrigation has, it seems, been employed, according to their veracious historians, for a period long before that assigned to the flood. In Italy, especially on the banks of the Po, the cultivators of the earth have certainly employed this process for a period previous to the days of Virgil. (*Georg.* lib. i. v. 106-9)—

Deinde satis fluvium inducit, rivosque sequentes—

and it is still carried on with a zeal and care worthy of the art they practice. M. P. Cato, the earliest of the Roman writers upon agriculture, (150 years before Christ,) in his ninth chapter, told the Italian farmers to "make water meadows if you have water, and if you have no water, have dry meadows." The directions of Columella seem to have all the freshness of a modern age about them. He was the first who noticed the inferior nutrition afforded by the hay from water meadows. "Land," says he, "that is naturally rich, and is in good heart, does not need to have water set over it; and it is better hay which nature, of its own accord, produces in a juicy soil, than what water draws from a soil that is overflowed. This, however, is a necessary practice when the property of the soil requires it; and a meadow may be formed either upon a stiff or free soil, though poor when water may be set over it; neither a low field with hollows, nor a field broken with steep rising ground, is proper; the first, because it contains too long the water collected in the hollows; the last, because it makes the water run too quickly over it. A field, however, that has a moderate descent may be made a meadow, whether it be rich, or so situated as to be watered; but the best situation is where the surface is smooth, and the descent so gentle, as to prevent either showers, or the rivers that overflow it, remaining too long; and, on the other hand, to allow the water that comes over it quietly to glide off; therefore, if in any part of the field intended for a meadow, a pool of water should stand, it must be let off by drains, for the loss is equal either from too much water or too little grass." (*Col.* lib. ii. c. 16). Pliny tells us that "meadows ought to be watered immediately after the spring equinox, and the waters restrained whenever the grass shoots up into stalks" (*Nat. Hist.* lib. xviii. c. 27). When, after the fall of the Roman empire, agriculture, in common with all other sciences, rapidly declined, a very remarkable exception to this melancholy result of slavery and despotism was presented in the case of irrigation, which was carried on and extended through the long period of the dark ages with equal zeal and success. This was more especially the case in Lombardy, where it was certainly prosecuted on a very bold and profitable scale long before 1037. The princes of Lombardy patronized and followed the example of the various religious establishments, which then monopolized all the wealth and learning of the land, in extending the employment of water in all possible directions. The monks of Chiazevalle, in particular, were so celebrated for their knowledge of this branch of agriculture, and of hydraulics in general, that the emperor, Frederick the First, in the thirteenth century, very gladly sought their advice and assistance. This system has ever been zealously and carefully extended and improved, in every possible way. The waters of the chief rivers of the north of Italy, such as the Po, the Adige, the Tagliamento, and of all the minor streams, are employed in irrigation. There is no other country which possesses an extent of rich water meadows equal to that of the Lombards. The entire country from Venice to Turin may be said to be formed into one great water meadow; yet the irrigating system is not confined to grass lands; the water is conveyed into the hollows between the ridges in corn lands, into the low lands where rice is cultivated, and around the roots of vines. From Italy the practice extended into the south of France, into Spain, and then into Britain. In the states of Lombardy, the water of all the rivers belongs to the state; in those of Venice, the government extends its claims to that of the smaller springs, and even to collections of rain water, so highly, for the use of the cultivator, is water of every kind valued in the north of Italy. It is necessary, therefore, in Lombardy, to purchase from the state the water taken from the river; this may be taken, by means of a canal, through any person's grounds, the government merely requiring the payment of the value of the land to the proprietor, and restraining him from carrying his canal through a garden, or within a certain distance of a mansion. The water is sold by the government at a certain rate, which is regulated by the size of the sluice, and the time the run of water is used; this is either by the hour, half-hour, or quarter, or by so many days at certain periods of the year; the right to these runs of water is regularly sold like other property. Arthur Young gives an account of the sale of an hour's run of water through a sluice near Turin, which produced, in 1778, 1500 livres. The rent of the irrigated lands in the north of Italy is, upon an average, more than one-third greater than the same description of land not watered. (*Com. Board of Agr.* vol. vii. p. 189).

In Bengal, wells are dug in the highest part of their fields, and from this, by means of bullocks and a rope over a pulley, water is raised in buckets and conveyed in little channels to every part of the field. No attempts at cultivation are here made without the assistance of water, obtained by some mode or other.

The art of irrigation was not confined to the old world. The Mexicans practised it long before the days of Columbus; they collected the mountain torrents, and conducted their waters to their lands in proper channels, with much care and address. It was only towards the termination of the seventeenth century that water-meadows were constructed in Britain upon any thing like a regular system. Of these, those in Wiltshire, which are amongst the most celebrated in England, especially those in the Wylev Bourn, were made between 1700 and 1705. Those of Hampshire and Berkshire were constructed about the same period, but they were at first formed very inferior to the modern water-meadow lands of those counties. Great improvements were made towards the conclusion of the eighteenth century, through the publications of G. Boswell on meadow watering in 1780, and of the Rev. T. Wright, of Auld, in Northamptonshire, whose writings appeared at intervals from 1789 to 1810. It is noticeable that the water employed for these celebrated southern meads is perhaps the most clear and swift flowing of all the English rivers: issuing from the chalk formation, it is equally copious and transparent. Some of the chief advantages, therefore, of irrigation may evidently be derived from almost any description of water; for it is proved by the good effects produced by the brilliant chalk-waters of the south of England, and the still greater fertilizing effects of those surcharged with organic matter, as in the Craigintinny meadows near Edinburgh, that there is no water too bright or

too full of impurities, to be useless for the purposes of irrigation.

I propose in this paper to investigate the chemical properties of river water, and of the effects produced by it in irrigation, adding a few remarks upon the practice of the best and most skilful cultivators of the water-meadows of the south of England.

1. With regard to the composition of river water, there have been several chemical examinations; that of the Thames was analyzed by Dr. Bostock, who found, in 10,000 parts after most of its mechanically suspended matters had subsided, about $1\frac{3}{4}$ parts of foreign substances, viz.—

	Parts.
Organic matters	0.07
Carbonate of lime	1.53
Sulphate of lime	0.15
Muriate of soda	0.02

In an equal quantity of the waters of the Clyde, Dr. Thomson found $1\frac{1}{6}$ part of solid substances, namely,—

	Parts.
Common salt	0.369
Muriate of magnesia	0.305
Sulphate of soda	0.114
Carbonate of lime	0.394
Silica	0.118

The water of the Itchen in Hampshire is one of the most celebrated of all the southern streams, for the use of the irrigator. I found in 10,000 parts of its water, about $2\frac{1}{2}$ parts of solid matter, viz:—

	Parts.
Organic matter	0.02
Carbonate of lime	1.89
Sulphate of lime	0.72
Muriate of soda	0.01

From an examination of the substances found in these streams and they afford a pretty correct view of the contents of most others, the farmer will see that they all yield ingredients which are the food or natural constituents of the grasses. Thus, sulphate and carbonate of lime are found in most of them, and there is no river water which does not contain, in some proportion or other, organic matter. To ascertain, therefore, whether pure water was alone able to effect all the magic effects of irrigation, it was necessary to employ other water than that of rivers, lakes, or even springs. Pure water, as obtained by distillation, therefore, has been tried as a supporter of vegetation, but it was found totally inadequate to the support of plants,—they merely vegetated for a time, but they could not, by any means, be made to perfect their seeds. In this conclusion, the experiments of Dr. Thomson, and of MM. Saussure and Hassenfratz, entirely agree. Pure water, therefore, notwithstanding the dreams of the Greek philosophers, and the celebrated deceptive experiments of Van Helmont with his willow tree, is not able to support the growth of the grasses. Van Helmont's tree, when he planted it in an earthern pot, weighed five pounds; the earth previously dried in an oven, weighed 200 pounds; after five years it weighed 164 lbs., although it had been watered during that time with only rain and distilled water, and the earth had lost only two ounces in weight. Hence, said Van Helmont and his disciples, water is the sole food of plants. Bergman, in 1773, first pointed out the source of error. He showed, from the experiments of Margraff, that the rain-water contained a sufficient quantity of earth to account for the increased weight in the willow, every pint of rain-water containing one grain of earth. Then, again, the earthen vessel (which was sunk in the earth) would in this experiment transmit its moisture impregnated with all kinds of soluble substances. And yet, it has been shown, that impure water, such as that from a sewer or from a dunghill, is alone sufficient to sustain vegetation. This was clearly evidenced in the experiments of M. Lampadius; for he found, that plants placed in a pure earth, such as silica or alumina, although they would not grow when watered with pure water only, yet, when watered with the liquid drainage of a dunghill, they flourished very luxuriantly, and this fact has been also proved in another way. It has been shown by chemical analysis, that the quantity of solid or earthy matters absorbed by plants, is in exact proportion to the impurity of the water with which they are nourished. Thus, equal quantities of some plants of beans, fed by distilled water, yielded

	Parts.
Of solid matters or ashes	3.9
Those fed by rain-water	7.5
Those grown in garden mould	12.0

These facts strongly confirm the conclusions of some of the most sagacious cultivators, that the chief advantages of irrigations are attributable to the foreign substances with which the water is charged, although, as I have elsewhere observed, almost every farmer has a mode of accounting for the highly fertilizing effects of irrigation—one thinks it cools the land, another that it keeps the grass warm in winter. And this was Davy's opinion. He thought that a winter flooding protected the grass from the injurious effects of frost. He says, "Water is of greater specific gravity at 42 deg. that at 32 deg.—the freezing point; and hence, in a meadow irrigated in winter, the water immediately in contact with the grass is rarely below 40 deg., a degree of temperature not at all prejudicial to the living organs of plants. In 1804, in the month of March, I examined the temperature in a water meadow near Hungerford in Berkshire, by a very delicate thermometer. The temperature of the air at seven in the morning, was 43 deg. In general, those waters which breed the best fish are the best fitted for watering meadows, but most of the benefits of irrigation may be derived from any kind of water."

Such were the opinions of Davy as to the fertilizing properties of water. It is to be regretted that the opportunities for agricultural observations of this great chemical philosopher were so few, for his valuable remarks were always cautiously made. He appears, however, as I have remarked elsewhere, never to have steadily investigated the chemical composition of river-water with regard to its uses in irrigation, and, in conseqnence, knew little of the value of some of its impurities to vegetation. Thus, if the river water contains gypsum (sulphate of lime,) which it certainly does—if the water is hard, it must, under ordinary circumstances, on this account alone be highly fertilizing to meadows, since all grasses contain this salt in very sensible proportions; for, calculating that one part of sulphate of lime is contained in

every two thousand parts of river water, and that every square yard of dry meadow soil absorbs only eight gallons of water (and this is a very moderate allowance, for many soils will absorb three or four times that quantity,) then it will be found that, by every flooding, more than one hundred weight and a half of gypsum per acre is diffused through the soil in the water, a quantity equal to that generally adopted by those who spread gypsum on their clover crops, lucerne, and sainfoin, as a manure, either in the state of powder, or as it exists in ashes. And if we apply the same calculation to the organic substances ever more or less contained in flood waters, and allow only 20 parts of animal and vegetable remains to be present in a thousand parts of river water, then we shall find, taking the same data, that every soaking with such water will add to the meadow nearly two tons per acre of animal and vegetable matters, which, allowing in the case of water meadows, five floodings per annum, is equal to a yearly application of ten tons of organic matter.

The quantity of foreign substances present in river water, although commonly less, yet very often exceeds what I have thus calculated to exist in it. I have found it impossible, however, to give, from analysis, the amount which, under ordinary circumstances, is present in river waters, with any tolerable accuracy, since the proportion not only varies at different seasons of the year, but a considerable proportion of the merely mechanically suspended matters subside, when the specimen water is suffered to rest. In my conclusions with regard to the theory of irrigation, I have found many excellent practical farmers concur. Thus, Mr. Simmons of St. Croix, near Winchester, considers that the great benefit of winter flooding for meadows is derived, in the first place, from the deposits made by the muddy waters on the grass; and, secondly, from the winter covering with water preventing the ill effects to the grass of sudden transitions in the temperature of the atmosphere. This gentleman is perfectly aware of the value of the addition of the city drainage of Winchester to the fertilizing qualities of the Itchen river water, and of its superiority for irrigation after it has flowed past the city, having water meadows both above and below the town; and he finds that if the water has been once used for irrigation, that then its fertilizing properties are so materially reduced, that it is of little value for again passing over the meadows; and so convinced is he of this fact by long experience, that, having in this way long enjoyed the exclusive and valuable use of a branch of the waters of the Itchen for some grass land, a neighbor higher up the stream followed his example, constructing some water-meadows, and using the water before it arrived at those of my informant, who, in consequence, found the water so deteriorated in quality (though not sensibly diminished in quantity), that he had once thought of disputing the right with his more upland neighbor. The experience of other irrigators tends to the same conclusion. In the best managed water meadows of Hampshire the farmer does not procure annually more than three crops of grass; yet in situations where a richer water is employed, as near Edinburgh, four or five are readily obtained. It is evident, therefore, that the chemical properties of water have a much greater influence in irrigation than is commonly believed. The quality of the water, therefore, employed for the purposes of irrigation, is of the first importance to be well understood by the farmer; and although many more modern discussions have taken place upon the subject, yet the definition which the great Lord Bacon gave in his Natural History, of the advantages of "Meadow Watering," has never been excelled--"that it acts not only by supplying useful moisture to the grass, but likewise by carrying nourishment dissolved in the water." This nourishment is, generally speaking, composed almost entirely of the animal and vegetable matters mechanically suspended or chemically dissolved in the water; the fouler the water the more fertilizing are its effects. The objection which has been sometimes urged to this explanation, by instancing the prejudicial effects of some very thick muddy waters (as those of the Humber) on meadow lands, is very erroneous; for, in those cases, the mud deposited on the grass did not consist of animal or vegetable matters, but of fine earthy particles, such as clay or chalk, substances of which the alluvial soil, on which the same flood waters had for ages occasionally deposited their earths, was in fact entirely composed, and to which, in consequence, any farther supply was almost useless, the earthy slime merely covering the grass with mud, without adding a single fertilizing ingredient not already abounding in the soil. If, however, the soil is naturally deficient in any of the earthy ingredients contained in the water, then even such flood waters are ever found most fertilizing.

"The agency of water in the process of vegetation," says Mr. Stephens, "has not till of late been distinctly perceived. Dr. Hales has shown that, in the summer months, a sunflower, weighing three pounds avoirdupois, and regularly watered every day, passed through it or perspired twenty-two ounces each day, that is, half its weight. Dr. Woodward found that, in the space of seventy-seven days, a plant of common spearmint increased seventeen grains in weight, and yet had no other food than pure rain water; but then he found that it increased more in weight when it lived in spring water, and still more when its food was Thames water." (Practical Irrigator, p. 2.) And when speaking of the fact, that some irrigators think clear spring water equal to any, he adds (p. 24), "I would recommend to those who are of the same opinion, to inspect the irrigated meadows which are watered by the washings of the city of Edinburgh, where, I trust, they will find the superiority of muddy water to that of clear spring water most strikingly manifested."

Edinburgh has many advantages over the most of her sister cities; the large supply of excellent spring water is one of the greatest blessings to her numerous inhabitants, both in respect to household purposes and keeping the streets clean, as well as irrigating the extensive meadows situated below the town, by the rich stuff which it carries along in a state of semi-solution, where the art of man, with the common sewer water, has made sand hillocks produce riches far superior to anything of the kind in the kingdom, or in any other country.

By this water, about two hundred acres of grass land, for the most part laid into catch-work meadows, are irrigated; whereof one hundred and thirty belong to W. H. Miller, Esq., of Craigin-

tinny, and the remainder, to the Earls of Haddington and Moray, and other proprietors. The meadows belonging to these noblemen, and part of the Craigintinny meadows, or what is called the old meadows, containing about fifty acres, have been irrigated for nearly a century. They are by far the most valuable, on account of the long and continual accumulation of the rich sediment left by the water; indeed the water is so very rich, that the tenants of the meadows lying nearest the town have found it advisable to carry the common sewer water through deep ponds, into which the water deposits part of the superfluous manure before it runs over the ground. Although the formation of these meadows is irregular, and the management very imperfect, the effects of the water are astonishing; they produce crops of grass not to be equalled, being cut from four to six times a year, and the grass given green to milch cows.

The grass is let every year by public sale, in small patches of a quarter of an acre and upwards, and generally brings from 24*l.* to 30*l.* per acre per annum. In 1826, part of the Earl of Moray's meadow fetched 57*l.* per acre per annum.

About forty acres of the Craigintinny lands were formed into catch-work water meadow before the year 1800, which comprises what is called Fillieside Bank old meadows, and is generally let at from 20*l.* to 30*l.* per acre per annum. In the spring of 1821, thirty acres of waste land, called the Freegate Whins, and ten acres of poor sandy soil, were levelled and formed into irrigated meadow, at an expense of 1000*l.* The pasture of the Freegate Whins was let, previously to this improvement, for 40*l.* per annum, and the ten acres for 60*l.* They now bring from 15*l.* to 20*l.* per acre per annum, but may be much improved by judiciously laying out 200*l.* more in better levelling that part next the sea, and carrying a larger supply of water to it, which might be easily done without prejudice to the other meadows.

This, perhaps, is one of the most beneficial agricultural improvements ever undertaken; for the whole of the Freegate Whins is composed of nothing but sand, deposited from time to time by the action of the waves of the sea. Never was 1000*l.* more happily spent in agriculture; it not only required a common sewer to bring about this great change, but a resolution in the proprietor to launch out his capital on an experiment upon a soil of such a nature.

Since the making of the Freegate Whins into water meadows, Mr. Miller has levelled and formed forty acres more of his arable land into irrigated meadow, worth, before the formation, 9*l.* per acre per annum. It will only require a few years before these meadows will be as productive as the former; for it is evident that the longer water is suffered to run over the surface of grass land the greater quantity of fertilizing substance will be collected; therefore, as the water is so very superior in quality to all other water, a speedy return for the capital laid out may be expected. The expense of keeping these meadows in repair is from 10*s.* to 15*s.* per acre per annum, which is more than double the expense of keeping water meadows in repair in general.

It by no means, however, follows, as a necessary result of any contemplated improvement in irrigation, that the water should previously undergo a chemical examination. There are many other modes by which the farmer can form a pretty correct conclusion as to the fertilizing properties of the water he proposes to employ.

The surest proofs, says Mr. Exter, of the good quality of water (and the observations of this gentleman will be readily confirmed by the irrigators of the southern counties,) as a manure, are the verdure of the margin of its streams, and the growth of strong cresses in the stream itself; and wherever these appearances are found, though the water be perfectly transparent, the occupier of the soil through which it flows may depend, in general, of having a treasure, if he is attentive to it; but that this is not invariably the case, and that there are instances where a good water will not improve the herbage of certain soils, is proved by the following account (and there are several other cases with which I am acquainted) of the meadows of Mr. Orchard, of Stoke Abbey, Devon. These two meadows are situated on the side of a hill, their aspect nearly south—the superstratum a fine rich loam, from eight to ten inches deep, on a substratum of strong yellow clay. No difference whatever can be seen by the naked eye, in either the upper mould or the substratum, or in the herbage growing on the surface of them; except that, in the lower part of one, a few rushes appear, in consequence of some small springs which rise near them, but the water from them is not sufficient to render any part of the land poachy. At the head of the two meadows is a large pond, formed by the collecting of some small runs of spring water rising near it, and which is also improved by the wash of a small farm-yard adjoining, which, of course, must add to its efficacy as a manure. When this water is thrown over one of the meadows, it produces the richest herbage in abundance, and this field is regularly mowed for hay; on the other meadow, though repeatedly tried, it produces no good whatever. (Ann. of Agr. vol. xxx. p. 206.)

This result is attributable to the superior tenacious, retentive quality of the substratum of the lower field, or of some chemical difference in the composition of the soil; and although almost any description of soil is adapted to the formation of water meadows, those of a heavy clay description are generally the most unsuitable, those of a light or peaty kind are better, and those with a sandy or very absorbent gravel substratum still more so. There are some of the most celebrated water meadows on the banks of the Kennet of this description, and many of the best on the banks of the Wiltshire Avon have a mass of broken, porous flints for a subsoil. Those near Edinburgh, irrigated by the city drainage, rest upon the sands thrown up by the sea.

It is evident, therefore, that it is as important an object in the construction of these meadows to secure a ready and rapid exit for the flood-waters, as to procure, in the first instance, a copious and fertilizing supply.

The farmer is generally well aware of the injurious effects to his meadows of suffering the water to remain too long on them. He watches, therefore, with much care, for the first indications of fermentation having commenced, which is evinced by the rising of a mass of scum to the surface of the water—putrefaction is now beginning in the turf, and he knows very well that if the water is not speedily removed, that his grass will be either

materially injured, or entirely destroyed; he hastens, therefore, to open his water-courses. There are some soils in the vicinity of Standen in Berkshire, however, of so porous a quality, they need not any drains to empty the water-courses; and, in fact, in many instances, the farmer does not even require them: after a few hours all the water is absorbed by the soil; and yet these lands, with hardly six inches of mould above the gravel, are amongst the richest of water-meadows; the roots of the grasses penetrate readily into the gravel, and the earliest and sweetest grasses are produced on them.

Almost any description of grass will flourish under proper management in water meadows. Those whose soils consist of peat resting on sand or on sandy loam, with a substratum of chalk or gravel, generally produce the meadow foxtail (*Alopecurus pratensis,*) the brome-grass (*Bromus arvensis,*) and the meadow-fescue (*Festuca pratensis,*) on the tops and sides of the ridges. The furrows and sides of the drains are usually tenanted by the creeping-bent, the hard fescue, the rough stalked meadow grass, and the woolly soft grass. In those water meadows, whose soil consists of a sandy loam on a clay subsoil, the chief grasses are commonly the creeping-rooted soft grass, crested dog's-tail, the meadow barley, and the sweet-scented vernal grass. But some grasses change their appearance in a very remarkable degree, when exposed under favorable circumstances to the influence of the flood waters. This fact is strikingly exemplified in the case of two small meadows situated at Orcheston, six miles from Amesbury in Wiltshire, denominated from their great produce, "the long grass meads." "These," says Davis, "contain together only two acres and a half, and the crop they produce is so immense, that the tithe hay of them was once sold for five guineas." Much discussion took place amongst the Wiltshire farmers, as to the nature of the crop of these meads, before it was at last shown that the greatest part of their herbage consisted of nothing else than the black-couch, or couchy-bent, the *Agrostis stolonifera*, one of the worst of the grasses or weeds which haunt the poor, ill-cultivated arable soils.

It is a very general, as well as correct conclusion of the English farmers, that the grass and hay of water-meadows is not so nutritious as that of the permanent pasture lands. The difference, however, is not so great as is commonly supposed. The late Mr. George Sinclair determinated this experimentally, and he is no mean authority with regard to all that relates to the grasses.

He obtained from the rye grass (*Lolium perenne,*) at the time of flowering, taken from a water meadow that had been fed off with sheep till the end of April, of nutritive matter, seventy-two grains; and from the same weight of this grass, taken from a rich old pasture, which had been shut up for hay about the same time, ninety-two grains. From the same grass from the meadow, that had not been depastured in the spring, one hundred grains. And from the same grass, from the pasture which had not been fed off, one hundred and twenty grains. All the grasses, in fact, where their growth is forced by the application of either liquid or solid manures, are found to contain nutritive matter in diminished quantities —this, too, was determined by Sinclair. From four ounces of a very rankly luxuriant patch of rye-grass, on which a large portion of cow dung had been deposited, he obtained of nutritive matter, seventy-two grains. From the same quantity of the same grass, growing on the soil which surrounded this luxuriant patch, he obtained one hundred and twenty-two grains.

And in a second trial, the same species of grass, on a soil entirely destitute of manure, afforded, of nutritive matter, ninety-five grains. On the same soil, excessively manured, the grass afforded only fifty grains. In these experiments, the plants were of the same age, and were examined at the same stage of their growth. (Hortus Gram. 384.)

With regard to the construction and management of water meadows, there are many practical works of the highest authority to which the farmer has ready access, and, in the following observations, therefore, I shall merely very briefly paraphrase the accounts given by Mr. Davis and others, of the practice of irrigation in the southern counties. In this, however, even since the time that Davis wrote, there has been a great and steady improvement. The land is better levelled, the slopes more evenly preserved, the water-way, aqueducts, and hatches, better constructed, and in many of the more recent improvements in the valley of the Itchen in Hampshire, the sliding-water doors are regulated by a cogged wheel turned with a moveable winch, so as to render them safe from alteration during the absence of the meadow-keeper.

The management of the Wiltshire and Hampshire water-meadows, as well as it can be briefly described, is as follows:—In the autumn, the after-grass is eaten off quite bare, when the manager of the mead (provincially the drowner) begins to clean out the main drain, and the main carriage, and to "right up the works," that is, to make good all the carriages and drains which the cattle have trodden in, so as to have one tier or pitch of work ready for drowning. This is immediately put under water, whilst the drowner is preparing the next pitch.

In the flowing meadows this work ought to be done, if possible, early enough in the autumn to have the whole meadow ready to catch the first floods after Michaelmas; the water, being the first washing of the arable land on the sides of the chalk hills, as well as the dirt from roads, is then thick and good; and this remark as to the superior richness of the flood waters, is one that is commonly made in Berkshire and other parts of England. The length of the autumnal watering cannot be precisely stated, as much depends upon situations and circumstances; but if water can be commanded in abundance, the custom is to give meadows a "thorough good soaking at first," perhaps for a fortnight or three weeks, with an intermission of two or three days during that period: and continue for the space of two fortnights, allowing an interval of a week between them. The works are then made as dry as possible, to encourage the growth of the grass. This first soaking is to make the land sink and pitch close together, a circumstance of great consequence, not only to the quantity, but to the quality of the grass, and particularly to encourage the shooting of new roots, which the grass is continually forming, to support the forced growth above.

While the grass grows freely, a fresh watering is not wanted: but as soon as it flags, the water must be repeated for a few days at a time, always keeping this fundamental rule in view, "to make the meadows as dry as possible after every watering, and to take off the water the moment any scum appears upon the land, which shows that it has already had water enough."

Some meadows that require the water for three weeks in October, and the two following months, will not, perhaps, bear it one week in February or March, and sometimes scarcely two days in April and May.

In the catch-meadows, which are watered by springs, the great object is, to keep the works very dry between the intervals of watering; and as such situations are seldom affected by floods, and generally have too little water, it is necessary to make the most of the water, by catching and rousing it as often as possible; and as the upper works of every pitch will be liable to get more water than those lower down, a longer time should be given to the latter, so as to make them as equal as possible. (Davis' Agriculture of Wiltshire, p. 125-7.)

In Berkshire they first flood their water-meadows about Michaelmas; these are situated principally on the banks of the Kennet. The first flooding they deem the richest in quality: this they keep on the land for about four days, then they dry them for about a fortnight, and after that the water is let on for three or four days more; those meadows which are the most readily dried are the most productive. There are none more so, in fact, than those which have a porous, gravelly, or broken flint bottom, from which the flood-water readily escapes, almost without drains. They begin to feed their meadows with sheep about the 6th of April, and continue feeding till about the 21st of May, when the meadows are again flooded for a crop of hay; the land is then flooded and dried alternately for three days until hay-time.

The number of acres of land in Wiltshire under this kind of management has been computed, and with a tolerable degree of accuracy, to be between fifteen and twenty thousand. Some considerable additions, however, have been made to the water-meadows of the district since this calculation was made. (Davis' Wilts., p. 122.) About the same number of acres are formed into water meadows in Berkshire, and a still larger number in Hampshire. No one has attended more carefully to his water meadows than Lord Western, on some of those situated on the London clay formation in the Blackwater Valley in Essex, a soil of all others, perhaps, from its tenacity, the least adapted to their successful formation, and his testimony is very important—"There is an old adage," says his lordship, "that water is the best servant in agriculture, and the worst master. Water has in itself intrinsic value, distilled through chalk, lime, or marl, it acquires a portion of their qualities, though preserving the most perfect transparency, and, coming down in torrents and floods, it carries along the finer particles of earth and manure from the mountains, or higher grounds, into the valleys; hence, of course, it is that the valleys derive their fertility, and the value of the meadow has been originally created by an accumulation of wealth from the hills." (On the Improvement of Grass-lands, pp. 5, 14, 23.)

"In descending the Jura mountains, which divide France from Switzerland, the very first pasture you find on the descent evinces the value placed on the mountain floods by the inhabitants of those districts; and, accordingly, every stream is sedulously directed and conducted over the pastures in a most skilful manner. The very washing of the roads in hasty rains is also attended to, and applied to the same purposes." This system of catching the uncertain flood-waters is known amongst farmers by the name of catch-work, and though highly valuable, yet they deem it infinitely less important to them than irrigation, which is watering (generally five or six times a-year) from a certain and ever-accessible head of water, as a river, &c. And yet Lord Western's test mony is decisive in favor of even one catch-flooding; for he observes, when speaking of the expense of constructing the requisite little channels to disperse the flood-waters over the grass—"In many cases it will be trifling, in some cases considerable; but when the farmer reflects that one winter's flooding will do more in many, I may say in most cases, than thirty loads an acre of the best rotten dung manure that can be laid upon his grass lands, he can hardly shrink from some considerable expenditure." If, then, the effects even of a catch-flooding with water are so great, how infinitely superior are the advantages capable of being derived from a regular constant supply of the enriching foul waters, like those issuing from the drains of a large city, which is even now most successfully employed near Edinburgh, but worse than wasted in the case of London. Whatever may be the value, in an agricultural point of view, of the solid contents of the London sewers, yet, to me, the absolutely liquid portion, for the purposes of irrigation, appear at least equally important.

There is no agricultural question, therefore, of more consequence in a national point of view, than that of the improvement of the soil by the practice of irrigation; for, in its prosecution, all the rich organic and other matters diffused through the rivers, which would otherwise be carried into the sea, are saved to agriculture. This is not, therefore a question like that attending most other modes of fertilizing the soil, merely transposing manure from one field or district to another: but it is the absolute recovery, as it were, from the ocean, of a mass of finely divided enriching substances, constantly draining from the land. It is the effectual diversion of a stream which is ever steadily impoverishing all cultivated soils, and which unnoticed, and in too many instances deemed worthless, gliding into the ocean, is almost the only drawback to the steadily increasing fertility of our country.

GYPSUM.

From the Genesee Farmer.

Josiah Bordwell, of South Hadley, Mass., has four acres of pasture ground, and applies to it annually one thousand pounds of gypsum. The same application, and at the same rate, has been made 35 years in succession. On this lot he pastures annually one large yoke of oxen, one horse, two cows, and some years three cows. Prior to the use of plaster, Mr. B. says it required at least

six acres of this land to afford as much feed as he has obtained from one acre, by using plaster.

He has also a piece of mowing ground which contains four acres. Two crops of hay are taken from it regularly. On this ground he uses plaster of Paris freely, and applies a top-dressing of manure. His annual product of hay is fully sixteen tons.

For the Farmers' Register.

ADDRESS ON THE FORMATION OF THE AGRICULTURAL SOCIETY OF ESSEX.

At a meeting of the farmers and planters of Essex, convened at Tappahannock, on the 28th March, 1842, for the purpose of forming an Agricultural Society, the following address was delivered by their countryman,

JAMES M. GARNETT.

Friends and brother farmers:—Few things have happened to me, for a long time past, which have gratified me more, than to find so many of you desirous to establish an agricultural society, and to be the individual invited by yourselves, to address you on the occasion. To be thus honored is, of itself, a circumstance which, I confess, has given me much pleasure. But I assure you with perfect sincerity, that my highest gratification arises from the reflection, that although our good old county has done many good things in her day, none I believe has ever rendered her so much real, substantial service, as she will almost certainly derive from the association which I earnestly hope you have all come prepared to establish. In every part of our own country where similar societies have been formed, and well managed, their good effects have soon become manifest to the most careless observer; and the experience of all foreign countries has borne ample testimony to the same facts. Still, we Virginians have not appeared generally well disposed to avail ourselves of these associations, however strong and conclusive their benefits appear, to all who will give them an attentive consideration. In fact, the members of our class every where, but especially in our own state, have always appeared to me less inclined than any others to combine into societies, and co-operate for their mutual benefit; and yet, none surely require it more. For our legislatures have always acted towards us, as if we alone could never be in need of that aid, which has scarcely ever been sought from them by any other class without being granted. Hence the greater necessity of striving by co-operation to help ourselves if we will persist in neglecting to use the means—always in our power—of obtaining legislative aid. These means are as perfectly simple, as they would be efficacious. We have only to substitute *real* instead of *pretended* friends for our legislators, and the work would be speedily accomplished. But in the absence of all effective legislation in our favor, and whilst we fail to seek it as we might, there are no means which appear to me so well calculated to supply the want of it as agricultural societies. They greatly accelerate the acquisition of that knowledge of our profession which is but slowly gained by solitary study and practice, even where we are really zealous in the pursuit of it. They furnish a cure for that self-conceit, so highly injurious to such of our brethren, as believe themselves too wise to be taught; by placing them in a situation to be convinced—where the disease has not gone too far to be cured—that others know more than they do. They serve to excite that "*esprit du corps*," which causes us to take a just pride in our profession, and in which our class is so deficient. They draw closer those bonds of fraternity which should always unite us indissolubly together. They greatly promote social intercourse; and thereby tend powerfully to mitigate, if not entirely to cure those animosities and bitter hatreds, with which party-spirit never fails to poison the hearts of all who give themselves up to its influence. In a word, agricultural societies are, so far as my experience enables me to judge, the sources of unalloyed good to all who become zealous members thereof. And who can doubt it, that will reflect but for a moment on the nature and all pervading influence of that great cause, which it is the special object of agricultural societies to promote. A celebrated German agriculturist, whose late work on "Organic Chemistry in its application to Agriculture and Physiology" has become one of the text books in agricultural science, has summed up in a single sentence the chief circumstances which render this cause so great, and of such vital interest to all mankind. His words are, "There is no profession which can be compared in importance with that of agriculture; for to *it* belongs the production of food for man and animals; on it depends the welfare and developement of the whole human species, the riches of states, and all commerce." This single sentence contains what might be expanded into volumes of illustration and praise; but I confidently trust that all of my brother farmers who now hear me are sufficiently apprized of the essentiality of our profession to all the best interests of our country, not to require such a diffuse eulogium to recommend it farther to our special regard.

If it were my sole object to endeavor to make you fall in love with your profession, I might paint for your imaginations only the pleasures of agriculture, the green meadows, the verdant lawns, and glowing landscapes of well cultivated, highly productive fields, with which an all bounteous Providence hath enabled the cultivators of the soil to solace and regale both their animal and intellectual natures. Such an attempt would be both easy and delightful. But on the present occasion, I feel myself called on not only to exhibit some of the most striking advantages of agriculture to individuals and communities, together with the most practical means of improving it, but also to trace a warning chart of the shoals and quicksands, the rocks and barren wastes, that too frequently impede the progress of the husbandman, exhaust his substance, and mar his happiness. This, although the most necessary, is by far the most irksome part of the duty, which I shall now attempt to perform. In my endeavor to execute it properly, should I be so fortunate as to suggest any hints which may prove practically useful, I shall deem myself amply rewarded.

In regard to the general advantages of agriculture, both to individuals and nations, no one probably is so ignorant as to require much to be said

to him in the way of explanation. There are none, for instance, but must know, that the yeomanry of a country constitute the pay-all-class; that they furnish the means of subsistence, both in peace and war, to all other classes; that all taxes for the support of government, or any other public exigency, must ultimately come out of the land, and be drawn from it by the labor, skill and industry of those who own and cultivate it. How vastly important then, how absolutely necessary is it, that they should possess all the knowledge of their profession, both scientific and practical, which it is possible for them to acquire, since not only their own welfare, but that of every other class—nay, of the community itself of which they are members, vitally depends upon the extent of this knowledge, and the persevering diligence with which it is applied to all the various branches of husbandry. Yet, most strange to say, ours is a profession which multitudes of us appear to think may be practised successfully, as it were by instinct, for many, very many take it up without the slightest previous study or experience, and take it in high dudgeon, even if the oldest farmers venture to question their qualifications. What renders this misconception the more surprising is, that it is never made in regard to the simplest of all trades and callings, that even cobblers and tinkers are required to serve some apprenticeship, before they undertake to act as master-workmen. But *our* farmers make no such preparation, no, not they; although theirs is a vocation, which if estimated by its national importance, and the great variety of knowledge essential to the attainment of excellence therein, must certainly rank among the highest in society.

As to the means of our improvement in husbandry, although some small capital in money, or its equivalent, is generally deemed necessary to begin with, a capital in agricultural knowledge, sobriety, honesty, industry, and economy, is still more essential; for without these, and a good stock of them too, it is folly for any man to expect to reach a high standing in his class. To do this, he must carefully shun all extravagance, he must be just and fair in all his dealings, indefatigably diligent in all his farming operations, giving to each its due share of attention; perfectly sober in his habits, that he may be always fit for business as well as an example of sobriety to all under his command; and to crown the whole he must neglect no means within his reach to improve himself, both in the knowledge and practice of his profession. One of the most obvious of these means, especially for those who have no access to agricultural books, nor time to study them, is to become a member of some well managed agricultural society. All of these associations meet once or twice a year; and thus furnish opportunities for each member to learn, if he pleases, all that may be known by the rest, within the limits of their particular society. Here, then, any individual member who seeks information may acquire, in a day or two, more knowledge of his profession than he would probably gain in some years, by relying entirely on his own practice at home, unaided either by books, or conversation with farmers more experienced than himself. Moreover, his attendance on these meetings would be apt to inspire him with a more humble sense of his own agricultural knowledge, than most of us are apt to have who mix so little with our brethren as to have no opportunity of comparing our own acquirements with theirs. The neglect to do this is almost as sure to infect our minds with an overweening notion of our own knowledge, as the neglect to till our fields is, to fill them with noxious and pestiferous weeds. In fact, without a considerable degree of humility, there can be no desire to learn, for there is no consciousness of deficiency, no belief hardly in the possibility that others know more than we ourselves do.

Another advantage in attending the meetings of an agricultural society is, that we are apt to feel a livelier interest in our vocation; and to take a more enlarged view of its national importance, than we would ever possess, if we wilfully neglected, as too many of our brethren are apt to do, to look a little beyond our own thoughts for the means of improvement. To effect this most rapidly for our minds, frequent interchanges of opinion relative to every thing connected with our profession is quite as necessary, as the frequent application of fertilizing substances is to accomplish it for our lands. And he who neglects to avail himself of this all important fact, well deserves to live and die under the fatal curse of *that* ignorance, which self-conceit, and its constant companion, obstinacy, are sure to fix upon all who give themselves up to their influence. Most truly may it be said of any such man, "there is more hopes of a fool than of him."

I have said that one of the means of our improvement in husbandry is, to become an active member of some agricultural society. But much depends upon how this society is constituted, and how it is managed. To enable it to effect well the purposes for which it was established, all who become members should determine, and persevere in that determination, annually to do something more towards its support and improvement, than merely to pay punctually their subscription, although *this* should ever be deemed an indispensable duty. Each cultivator of the soil, however poor he might be, may certainly do this; for it does not require that a man should be rich to make and report accurate experiments on a small scale; and such experiments have often been known to result in the most important discoveries. In fact, some of those which have been most beneficial to mankind have been made by men comparatively poor. Again, members who are not cultivators, but belong to other professions and callings, may aid the cause very much, by always attending the meetings of their society, and exerting whatever influence they may possess to render it popular. We are all more or less creatures of imitation, and generally prone to do what we see others do. Of course, if many unite zealously in any pursuit, especially if it be one for the promotion of that greatest and most essential of all arts, the art of agriculture, others will assuredly follow, some merely for company sake, but numbers probably from the laudable motive of bearing a part in the general effort to do good.

Another means highly necessary to the beneficent operation of agricultural societies is, to establish and to cherish correct opinions, as to the nature and objects of the premiums which are usually offered by them. These are to excite a greater degree of fair, honorable competition, in

the various branches of husbandry than would probably arise without them; not, however, for the special benefit of the individuals who may engage in it, but more effectually to promote and improve the particular branch, wherein the competition is produced. This should always be borne in mind by the competitors, and they should always deem it highly dishonorable to become, what an old member of our Fredericksburg Agricultural Society has most aptly called "*prize fighters*," that is, men who compete for those premiums solely for the sake of the paltry gain, and who almost always withdraw, if disappointed in their sordid objects. If they do not take this step, which at once displays the baseness of their motives, they may always be known by the gross abuse which they never fail to utter against the committees that have decided against them. This is an evil to which all agricultural societies, that give premiums are constantly exposed; and there is none from which they should labor more to free themselves. But nothing, I believe, would do it, unless perhaps it were made a part of the constitution of every society to expel a member for accusing any committee of partiality, in fulfilling a duty which they can have no possible motive to abuse. On the contrary, they have every inducement which can operate upon men in such situations to discharge this duty faithfully, since they cannot possibly gain any thing by violating it. Possibly the disgrace of expulsion might deter these "prize-fighters" from indulging their ribaldry, when disappointed in obtaining a premium, although such a remedy is at least doubtful; for the men who would be most apt to offend in this way, have generally too little sense of honor and justice, to regard what a truly honorable man would consider a disgrace. The only thing which they really dread is either corporal or some other punishment that would take money out of their pockets. No agricultural society can ever derive the smallest benefit from them, and none should ever be admitted, if their characters could possibly be known beforehand.

I have said more, perhaps, on this subject, than some of you may think there was any necessity for saying. But if you form a society, as I sincerely hope you will, your members will be peculiarly fortunate, indeed, if they do not soon find among them some such disturbers of their peace and prosperity as I have described.

Let the foregoing remarks suffice to show how we may improve in our profession, by becoming members of some agricultural society. But this alone will be far, very far from making us good farmers and planters. We must not only learn all we can from our brother members, and be always ready to adopt their practices, whenever we see good reason to believe that they are better than our own, but we should dread, as we would poison, that pride and pertinacity of opinion which all our brethren are so apt to contract, who neither study their profession as a science, nor seek any other means to improve in its practice, than such as their own unaided thoughts may possibly suggest. This entire self-dependence for an increase of knowledge, soon swells into a degree of preposterous, arrogant self-conceit, which as effectually shuts the mind against the access of all truth, all improvement, as a good cork shuts a bottle from the admission of air. With hearts and intellects properly prepared for the acquisition of knowledge, by a proper distrust in our own acquirements, and a desire to increase them, both of which will be augmented by associating with men better informed than ourselves, we shall certainly be led to seek, not only *this* source of improvement in our profession, but we shall resort also to agricultural books.

Some of these, in the form of periodical papers, have now become so cheap, that every man who is not actually a pauper may easily furnish himself with at least one of them, as the cheapest costs only a dollar a year, although a single paper will often be found to be worth many dollars to him who will read it attentively. This remark I have very often heard, and from men too who were once silly enough to laugh at every thing in print, on the subject of husbandry, until they became thoroughly convinced of their own folly and obstinacy, in neglecting to ascertain for themselves, what agricultural books and papers really were. They then discovered that they were precisely the same with oral communications on the same subjects. The only difference being, that the first is the experience of farmers recorded *in print*, and the latter the experience, often of the same farmers, imparted *by word of mouth*. The facts, communicated in either way, must be exactly of the same value, as must also be all the speculations, either oral or printed, which may be blended with them; and stupid, indeed, beyond measure, must he be, who could not so distinguish between them, as to derive benefit from the facts, if worthy of regard, and avoid injury from the speculations, if they were either inconclusive or utterly visionary. This matter is now so generally and well understood, that the individual who ventures to sneer and scoff at what he is pleased to call "book-farming," will rarely fail to be thought a vain, conceited ignoramus, however he may escape being called so to his face. He can no longer thus disguise his own ignorance and aversion to learning, nor pass himself off, even among his most illiterate brethren, for a farmer of superior knowledge and skill in his profession; but must go for what he really is, an arrogant, opinionative boaster, utterly too lazy to study, too self-conceited to believe others better informed than himself, and far too proud to confess it, even if forced to see and to feel his own inferiority. I have said the more on this topic, because I verily believe that an overweening confidence in our own knowledge is the besetting sin of our class, owing to so few of us ever studying our profession as a science, to the solitary lives we generally lead, and to our consequent ignorance of the daily improvements which are constantly making in all the various branches of husbandry. Of these we must keep ourselves well informed, either by reading or frequent interchange of opinions, on all subjects connected with our profession, but both are best; or we must be content to suffer all the penalties and deprivations of our willful ignorance.

Another method of improving in our husbandry is one which few, very few pursue, although it really seems to me demonstrable that it would greatly contribute, not only to our knowledge, but to our wealth. It is, to lay out whatever clear profit, (if any,) which we can make from our

farms, in augmenting their fertility, rather than in adding to their size. Any man, who will take the trouble to make the calculation, may very soon convince himself of this fact, so highly important to all agricultural improvement. For instance, is it not perfectly plain, that if we increase our crops merely by increasing the surface cultivated, we must add a proportionate increase of labor and other means to make them, and of course have our expenditures and income relatively the same as before? We therefore gain no additional clear profit, although we gain not a little additional trouble in managing this increased labor. Yet almost every farmer, who has it in his power, continues to add negro to negro and acre to acre, whenever an opportunity offers; and thus not only fails to augment his own net income in the smallest degree, but actually contributes, by his perpetual buying up more and more land, without improving what he already owns, to depopulate the neighborhood in which he lives. In this way it has happened that in many parts of Virginia a single proprietor will now own many thousands of acres, which half a century ago, or within a shorter period, were divided into several distinct farms, each of which sufficed for the comfortable support of a different family, who might still have been living on them in abundance, if the money, time and labor, which it cost them to move and to form other far distant settlements, had been judiciously expended in improving the homes of their ancestors, and the lands which gave them birth. No man can doubt this, who knows, half as well as I do, how capable these lands are of being so improved as to yield even ten or twelve times their present average product. For it is a fact within my own knowledge, that many of our Virginia farms formerly produced per acre crops which exceeded what they now yield full as much as I have stated, whilst others which were almost barren, when I first knew them, having fallenin to the hands of improving proprietors, instead of the land-skinners who previously owned them, are now producing ten, fifteen, and even twenty-fold as much as they did in the hands of those deadly enemies to all agricultural improvement. It may be prejudice, but I confess I have always considered such men among the very worst members of society; for, although they increase for a time the means of human subsistence, it is solely for their own exclusive benefit, without the slightest regard for the general welfare or their own posterity; and under an absolute certainty of ultimately impoverishing their own state, by destroying the productiveness of her soil to the utmost extent of their power. To this deplorable situation they have reduced thousands upon thousands of acres of our once fertile soil. But with a knowledge of its capacity for improvement which most of its present owners possess, what should hinder them from restoring these lands to their former state, or to one still more productive, since many of them are now known to contain in their marl deposits the natural means of effecting this restoration? The only obstacle in regard to these farms is, either that sheer laziness in their proprietors, which causeth the sluggard to be continually saying to himself, "*yet a little sleep, a little slumber, a little folding of the hands to sleep,*" or else it is an inveterate habit of putting off from day to day what they wish and mean to do; a habit, by the way, which is utterly incompatible with every thing like good farming. Procrastination has been called "*the thief of time;*" but it is infinitely worse: it is the slow but deadly poisoner both of mental and bodily energy, rendering the best resolutions entirely abortive, and the greatest physical powers nearly as useless to us as if we did not possess them.

Our population, computed by the square mile, and compared with that of the northern and eastern states, falls very far short of theirs, although we have greatly the advantage of them both in soil and climate. Do any of you wish to know the reason? It is simply because *they* have been constantly and most industriously laboring to improve *their* lands, whilst we (with few exceptions) have been as constantly treating *ours* in a way that could not well have been worse, if we had actually been laboring with might and main to wear them out. I will not say that such was the design of our treatment; but the effect has certainly been the same as if malice prepense had instigated all our proceedings. No state pride, no attachment to the places of our nativity, no affection for kindred and friends, no devotion to agriculture, as the great source both of individual and national prosperity, has had any such influence over us, as to save our good old Mother Virginia from the almost hopeless impoverishment to which a vast portion of her soil has been reduced by the neglect, the abuse, and constantly exhausting culture of her improvident, reckless children. The deplorable consequence of this has been, that multitudes of them seem so disheartened by the prospect before them, as almost to have lost the power of making the necessary exertion to better their condition, although there are now very few neighborhoods, and no counties which do not afford some highly laudable examples demonstrative of what rapid improvement may be made of our exhausted soils, simply by persevering industry and labor, judiciously applied to the various processes by which worn out lands may be restored to a highly productive condition. There are no soils so poor as not to furnish to their owners more or less of such materials as may be easily converted into manure; for such are all substances that will rot. Moreover, a very large portion if not the greater part of our lands below the head of tide-water, abound with marl, that has never failed to restore land to fertility, wherever it has been judiciously applied. On farms destitute of marl, the numerous substances convertible into manure, aided by lime, plaster of Paris and red clover, will soon effect the object, and that too without any great outlay of cash, if we could only content ourselves with a small, gradual beginning. But our great misfortune is, that very few of us, even among those who have least property, have yet learned to practise upon the good old Scotch proverb—"*Many a little makes a mickle.*" Hence it happens with such persons, that because they cannot command money and labor enough to make, as it were, by a hop, skip, and jump, all the improvements they wish, they will not attempt to make any; but go on from bad to worse, until emigration presents itself as the only remedy for an evil which seems incurable, merely because no effort has been made to cure it. How long such num-

bers of our brethren will continue to labor under and to suffer from an infatuation so deplorable, so paralyzing, GOD only knows; but so long as they do, a man might as well preach to so many deaf adders, with the expectation of doing them any good. They seem infinitely to prefer lounging away their time at any place of public resort, where such dronish idlers as themselves are most apt to congregate. There, perhaps, they interchange very profound condolences about "the hard times," without the least apparent consciousness of their own participation in creating them; or, should a tippling shop be at hand, their favorite occupation generally is to settle the affairs of the nation therein, and ever and anon to wash down their patriotic effusions with copious libations of whisky and brandy to some political idol. In the mean while their farms are left in a great measure to take care of themselves, and to regain fertility, if that be possible, by almost total neglect. Happy for our country, and most happy for such persons themselves would it be, if by any means they could be cured of their self-destructive habits, and converted into industrious, frugal, persevering farmers. The whole appearance of our own state, as well as of many others, would soon be changed by it; we should cease to hear of any farm being deserted from its supposed incapacity to support its owners; and it would not be long before our good old Virginia would begin to look and to feel something like what she once was in her most prosperous days.

There is still another important change essential to our improvements in husbandry, which *all* of our farmers who have young sons are deeply concerned in making. It is, to abandon the preposterous practice of crowding nearly all of them into the professions of law and physic, instead of trying to make good farmers of them; than which there is no more honorable vocation, nor any one that has so many considerations to recommend it to our regard. Ask any man whom you please, if he does not feel certain that we have an overstock both of doctors and lawyers, and he will certainly answer *yes*. But still we are constantly adding to the number, as if there was really no other honest pursuit by which they could make a living. In the whole compass of supposition, there is (at least in my opinion) but one which will reconcile this practice to common sense; and I hardly think we shall find any gentleman of either profession willing to admit it to be true. It is, that to multiply lawyers and doctors is to increase sickness, diseases, and litigation. If adding to the former would diminish the number of the latter, as it certainly would, provided the doctors and lawyers were all masters of their profession, and strictly honest as well as conscientious, *then*, assuredly, any addition to the number of either must unavoidably lessen the total amount of income to be divided among them all; and consequently ought to prevent any considerate parent from devoting his son to the study of either law or medicine, at least so long as both professions continue to be so overstocked as they *are and have been* for many years past.

The following brief illustration of the difference between the sources of income, upon which lawyers, doctors and farmers necessarily depend, must place this matter in a point of view, the justness and truth of which no man in his senses can deny. For instance, the *farmer's thrift* depends upon the thrift and the health of all other trades, professions, and callings, for *all* are *his* customers, inasmuch as *he* produces the necessaries of life which all want, and must have, in proportion to their appetites and means of buying. On the other hand, the *lawyer's thrift* depends upon the number of disputes and quarrels in regard to property, of injuries to persons or character, and of frauds and crimes which *may* be committed within the limits of his practice; for, be it remembered, that none of these things are necessary incidents to society, although of too frequent occurrence. And the *doctor's thrift* depends on either the real or supposed unhealthiness of the persons among whom he lives. If few or none are litigious, few or none slanderous, few or none perpetrators of fraud or crime, the lawyer is in some danger of starving, instead of growing rich; whilst the physician is in quite as bad a predicament, should there be little or no sickness, few or no diseases. True it is, and most lamentably true, that such a condition of society cannot reasonably be anticipated; but we may confidently cherish the hope of a nearer and nearer approximation to it, if the great, the vital causes of *temperance* and *popular education* continue to advance, and to gladden the hearts of all true lovers of their country, as we now have every reason to believe they will. And so sure as they do, just so *sure* will fewer instead of more doctors and lawyers become necessary. But the well being of every community will always require some of each profession, and I am one of the last men who would maintain a contrary opinion. I have too great an esteem, too sincere a regard for the worthy men of both classes, to say any thing in disparagement of either good doctors or good lawyers, for I am happy to believe that many of them are among my best friends. All I wish is, to remind my brothers farmers of the old proverb, that we *may* have too much, even of a good thing; and to beseech them to recollect, that in our own profession there is still more ample room for more, many more recruits.

In making this assertion, I am fully sustained by the facts which our late census has disclosed in regard to our own state. But at present, I will refer only to those which more immediately concern our own comparatively small county. According to the authority which I have consulted, Essex contains only 280 square miles, or 168,000 acres. By the last census, our whole population in this county amounts to no more than 11,309 persons. Now supposing that three-fourths of this number are engaged in agriculture, and that only two-thirds of them are capable of labor, which seems to me a fair estimate, as none under ten and over seventy years of age ought to be counted, we shall have no more than 20 and a small fraction, who can properly be called agriculturists, to every square mile, which is a little over three to every hundred acres! This, I think, amounts to a demonstration, that we shall be in no danger whatever, for many, many years to come, of being overstocked with farmers and cultivators of the soil. Nay more, it proves most clearly, that if we consult the interest of Virginia husbandry, and the great national interests partly dependent thereon, we shall use all the fair means in our power, to induce our sons

to devote themselves to agriculture, in preference to any other profession. One of the most obvious of these means is, to improve our own knowledge of it, both by study and practice; for then we shall have the great advantage of addressing their understandings, by the all powerful agency of example, as well as by that of precept. When a parent heartily works by both, seldom indeed will he fail to succeed with his child in any thing; for among all the admirable lessons of wisdom, which we derive from that great store-house of soul-saving knowledge, the Holy Scriptures, there is not one of more practical utility, not one of more vital importance, than *that* which inculcates upon parents the absolute necessity of first doing as they would wish their children to do, before they have any right to expect good conduct from them. By the same divine authority, we are assured, that if we will bring up our children in the way in which they should go, they will not depart from it. If, therefore, any of my brother farmers who now hear me, desire that their sons should follow their own profession, as I certainly think they ought, these sons should be brought up to it, educated for it, and taught to love it. The very effort to do this, will benefit yourselves full as much as it will benefit them; for there is nothing which will operate so effectually, to make us sensible of our own want of instruction in any particular branch of knowledge, as the attempt to instruct others therein. This will soon expose to us our own self-conceit, without a consciousness of which, nothing can ever inspire us with an efficient desire to seek more information in regard to our profession, inasmuch as we foolishly imagine ourselves already possessed of all that we need have.

Should any of my hearers be in this self-complacent, opinionative condition, a condition so delectable to the individual himself, but so truly ridiculous to all others who behold it, I beseech him to try earnestly, if it be but for a single day, the experiment of teaching one of his sons the principles and practice of agriculture. And if this one effort did not so far open his eyes to his own ignorance, as to cure him effectually of all overweening confidence in his own knowledge of his profession, I should not hesitate to affirm of that man, that he was doomed to live and die, without any farther acquaintance with husbandry than he then possessed. To expect *him* to improve would be quite as hopeless a thing, as to look for it in one who was entirely destitute of all the faculties which render man an improveable creature.

Before I conclude, permit me to make one or two other suggestions which I deem very important to the successful operation of an agricultural society. The first is to make every member, as far as practicable, a *working member*, instead of what is generally called "a sleeping partner." To do this, the best method, I think, is one lately suggested by Mr. Ruffin, editor of that excellent paper, "The Farmers' Register." He recommends that the constitution of every agricultural society should require each member, who is a farmer, to make annually and report the results of at least three experiments, on a scale suited to his means, in regard to some disputed questions in agriculture; that at least half the funds of the society be offered in premiums for the best of these experiments; and that a fine of one dollar be imposed for every one that each farmer fails to make. This would keep all the members on the alert; and would certainly elicit, every years, some useful information which might be beneficial to all.

My next suggestion is, that in every case where premiums are offered, it should never be forgotten, that the sole purpose which they ought to aim at accomplishing is, to obtain the greatest results at the least expense of labor and materials. For instance, if the premium be offered for the greatest produce per acre, of any crop, let it always be made an indispensable condition that authenticated statements should be produced, not only of the quantity, but of the quantum and kind of manure, and labor expended in making it. Again, if the premium be offered for stock, let it be required that the whole process of rearing and fattening be stated in a manner equally well authenticated and particular. The same regard to economy should regulate all other premiums, not only to enable poor farmers to compete for them with a fair prospect of success; but because every agricultural society should make it one of the chief objects of its efforts to promote and encourage economy in all farming operations whatever. Without a due regard to *this*, no farm can properly be said to be well managed, since the net profit may be reduced to nothing, however large the crops, unless the various expenses in making them be constantly kept within the narrowest limits compatible with the progressive improvement of the farm, and the regular increase of the owner's clear income.

And now, my friends, I will no longer detain you from organizing your society, but conclude with the full assurance, that if properly sustained, it will rapidly improve you, both in the knowledge and practice of your profession; it will strengthen your conviction, that no other vocation contributes so much to independence, so much to health, plenty, and competence, if not to great riches; that it will enable all industrious, frugal owners and cultivators of the soil to provide well for themselves and families, to give much to them that need; but above all, to impart to their children that sound moral and religious education, which is the best, *incomparably the best legacy* a parent can leave to his child; for it ensures to him, so far as human means *can* do it, happiness both in this world and the world to come.

TO GUARD SHEEP FROM BEING KILLED BY DOGS.

From the American Agriculturist.

Perhaps one of the greatest obstacles to the keeping of sheep has been the savage destruction made among them by worthless curs kept throughout our country, for no other reason, that we could ever imagine, than to gratify the fancy of their owners. If these animals were kept constantly chained up where they could do no harm, no fault would be found; but when suffered to run at large and become public destroyers, it is quite another affair, and we hold every one justifiable, nay, a positive duty on their parts, to shoot all dog prowlers, without any more hesitation than they would a mad wolf.

The importation of the large Spanish shepherd dog has been recommended, as he will invariably attack and kill any dog that approaches his flock, but this would be an expensive and troublesome measure, and it would take a long while to breed a sufficient number of them here, before they could become generally effectual. During our recent visit to Kentucky, we learned a very simple, and at the same time profitable way of guarding sheep, which is this:—

Put a few active cows, with their sucking calves, in the same pasture with the flock—five would probably be enough for several hundred sheep, to which add five active three year old steers, and as many more two year olds. Take a gentle dog into the field, with a long light cord about his neck, the end held in the person's hand accompanying, to keep him in check, and then set him on to the sheep. The cows, thinking of their offspring, will immediately advance to head the dog and guard the calves, the steers will follow their example, and the sheep retreat behind them. Thus continue a few times, till the steers are well broke in, when the cows can be taken away and they will inevitably gore any dog to death that dare persist in attacking the flock. However brave a dog may be in other matters, the moment he attacks the sheep, he seems to be conscious of the ignominy of it, and as if conscience stricken, becomes a coward, and will run at the slightest approach from other animals.

When steers arrive at the age of four years, it is generally requisite to remove them to better pasture than is required for sheep, for the purpose of fatting, or they are wanted for the yoke. But just before this is done, add as many two year olds as you wish to remove of the older ones, and the three year olds left will soon break in the young ones, and so the system can be annually kept up as long as requisite.

For these guards, we would recommend a small active race of animals, with sharp horns, as they would more effectually gore and toss a dog, and it will require a small active animal to support itself on feed, that is generally as short as sheep pastures usually are. The hardy red cattle of New England would be admirable for this purpose, or indeed any active native animals, those chosen from the hill or mountainous districts would be best, as more fleet and pugnacious when required. We are told by hunters, that it is thus the wild buffalo protects himself, on the vast plains of the west, from the attacks of savage bands of wolves, and they not unfrequently afford protection to whole herds of deer. Mr. Hart, of Kentucky, defended the deer in his park by the elk, a single pair of which, would be sufficient to guard hundreds of them, as they would run down the fiercest dog in a few minutes, and cut him in two by perhaps a single stroke of the sharp hoofs of their fore feet.

IRISH POTATOES AND OATS IN NEW LAND.

From the N. H. Monthly Visitor.

We have heretofore endeavored to impress upon our readers the value of our rough mountain lands. There yet remains much land in the upper counties of this state considered of little value that may be made valuable. In conversation with Winthrop Folsom, Esq., of Dorchester, a few days ago, we gathered the following facts:

Four or five years ago he purchased a lot of eight acres of uncleared rocky land, for which he gave three dollars per acre: this land, covered with a growth of wood, he cut down, cleared, burnt and fenced at an expense of eight dollars per acre—making the cost of land eleven dollars per acre. It was planted with potatoes: he charged himself one dollar for every day's work done, and twenty-five cents per bushel for the seed potatoes. He called the potatoes raised that year on the ground worth sixteen cents the bushel; and he found the gain of this year's operations, above the cost of land and clearing and the expense of seed and labor, to be ninety dollars, or nine dollars per acre. The next succeeding year he raised on the same ground four hundred bushels of oats: since that time the same land has produced a decent crop of hay, and is now good pasture land.

Mr. Folsom has more recently purchased a lot of three hundred acres of these wild lands at the price of one dollar an acre. On this land he has commenced clearing. His first clearing was fifteen acres at the cost of eight dollars an acre. His first crop of potatoes on this ground was 3,100 bushels. Three thousand bushels sold to the starch manufacturers at one shilling the bushel, brought $500—one hundred bushels drawn home worth $17—making the year's product $517. The cost of land, fencing and clearing, $160, would leave the clear gain of this year's operations on these fifteen acres, three hundred and fifty-six dollars. The second year, (which was the last year, when the crop suffered much from drought) the same land produced 475 bushels oats, worth at 50 cents, 237.50, and 14 bushels of rye worth $1.00, making $251. After the two crops were taken off, it would not be high to value this land at five dollars the acre.

The method of planting the potatoes is extremely simple. After the ground has obtained a good burn, the planter proceeds with a bag of cut potatoes swung over his shoulder—strikes a sharp hoe into the ground through the outside root turf—covers with the foot, making each hole at the distance of about eighteen inches in the row, and the rows three feet apart. Planting in this way makes three fair days' work to the acre, worth $2.25. The digging of an acre of potatoes at four shillings per day, six days' work, is worth $4. No hoeing during the season is necessary; and so well does the seed operate in the ground, that the vines often grow to a sufficient size to cover the land. The whole expense of raising potatoes on burnt ground, after the ground is cleared, Mr. Folsom informs us, will not much exceed six cents a bushel.

SOWING CORN BROADCAST.

From the American Farmer.

In the Farmer of April 20th, I observe over the signature of "Ledyard" some inquiries in relation to sowing corn broadcast, and the best method of securing the crop.

Having tried the experiment last year I offer a

few suggestions as the result of my experience. I sowed a few acres with a view of ploughing it in as a green crop for the benefit of the soil, but was tempted, by its luxuriant appearance and a scarcity of other provender, to make use of it for that purpose. The quantity of seed sown was about 2 bushels per acre. Perhaps in a very rich soil, the use of a smaller quantity of seed might be attended with the objections named in the remarks which follow the inquiries of your correspondent, viz.—"the tendency of weeds to check its growth."

After the ground is well harrowed and sown, I would recommend your correspondent to make use of the cultivator to cover the seed—which by the way I have found an excellent improvement for covering seed wheat. The ground should then be rolled smooth, which is all that is necessary to be done until the time of harvesting arrives. My crop was cut just at the time the grain began to harden—and the lower leaves of the stalk were becoming shrivelled. The fodder was suffered to lay on the ground for a day or two until the stalks had become sufficiently wilted, to be made use of as *bands* for tying the fodder in *small* sheaves; after being bound the sheaves are set up in small shocks of about one dozen sheaves each, and *capped* by placing one sheaf on the top as a crown to shelter the shock from rain. In this state it remained until perfectly *cured*, when it was carted off and stacked up in a convenient place for feeding. I find this far superior to the "whate straw" of our friend Paddy, for it don't require *any thing at all*. E. P.

P. S. With respect to the proper time of sowing, I would suggest that the usual time of planting corn is the most fit season where the crop is to be used as dry fodder.

Balt. Co., April 21*st*, 1842.

THE FRUIT CURCULIO. FRENCH RECEIPTS TO GUARD AGAINST THE BLACK WEEVIL.

To the Editor of the Farmers' Register.

Hillsborough, N. C., April 8*th*, 1842.

I send you the following fact, in confirmation of the view you have taken of the application of marl or shells to the soil around fruit trees. I see that Mr. Downing, of Newburg, takes a similar view of the matter, and recommends clay.

The fact to which I allude is this. A few years since, while at the house of a very intelligent farmer, of Lincoln county in this state, I was forcibly struck with the lively and *clean* appearance of his plum trees, which were then loaded with fruit. On inquiring of his mode of treatment, he remarked that the only secret in the case was, to set them out by the *road side*, (as his were) or along some path, where the ground would be trodden down as hard as possible.

It would appear therefore, that the rationale of the thing is not to be sought in the shell marl or in the clay, but in having such a hard pan of earth around and under the trees, that the insects which infest them cannot get a lodging place in the soil.

This subject reminds me of numerous receipts, against various insects which are so troublesome to agricultural and domestic economy, that are found in a French work, entitled "Secrets concernant les Arts et Métiers," published in 1790, in four volumes. In reading it over lately, it occurred to me, that possibly some of the secrets for destroying insects might be valuable; and if so, that I would be doing good service to furnish them for your paper. I have no means of knowing whether they are useful, and will therefore send you a specimen, and let you judge for yourself. If you think them worth publishing, let me know, and plenty more of the secrets shall be forthcoming.

—

Mode of protecting grain from the weevil and other insects.

Soak a woollen or linen cloth in water, and after wringing it out, spread it over your grain. In two hours the weevils will be found attached to it.

Against weevils.

Take as much lie as is necessary for washing over your granary, in which boil a quantity of ox-gall, (an excess need not be feared,) and wash your granary with the mixture.

Another mode.

Spread branches of the elder over your grain heap, and the insect will retire to the walls, from whence it will be easy to sweep them up and burn them. To make the odor more effective, the leaves and branches may be bruised.

Another.

After the grain has been removed from the granary, spread a large quantity of the branches of the box over the floor, and let them remain till the grain is put in; when they should be put along the walls, partitions, joists, &c., as well as on and around the grain.

Another.

Let your barn be emptied and swept, after which let a flock of sheep lie in it for six weeks. The odor of these animals will kill the weevils. Should they make their appearance again, the following method should be adopted:

Another.

Place in the middle of your barn, or granary, a large iron pan of burning charcoal, closing the doors and windows tightly. Cut three or four old shoes into small bits and throw them upon the fire, to which may be added the hoofs of horses, &c. The fire should be kept up for three or four hours. The strong odor of this smoke will infallibly kill the weevil, &c. This process should be repeated every year before housing your grain. It also drives away rats and mice.

[I think this process would be pretty sure to kill men!]

Another.

Sprinkle the floors and walls of your granary with a decoction of garlic, well steeped in a sufficient quantity of salt water. The odor of this is no sooner diffused than the weevil dies or goes away.

Wormwood, rue, savory, lavender, green coriander, and all plants of a strong odor have the same effect.

Another.

Melt Burgundy pitch, and by means of a bit of tow make a slight coating of it upon the shovels used for stirring the grain heaps, and then rub them over with the oil of petroleum. After turning the grain with them two or three times, the weevils will disappear. It will be necessary to renew the oil and pitch whenever they become detached from the shovels.

The above are some of the first "secrets contre les insects and les animaux nuisibles," and are a fair specimen of the whole. Some of the processes I should judge to be inert. You can perhaps determine whether *any* of them are valuable. Very respectfully and truly yours,

M. A. Curtis.

[The foregoing recipes all apply, it is presumed, to the *black weevil*, a small insect of the beetle tribe, which has wings, but is not known to fly, which lives through the winter, and infests mills and granaries which have grain always in them, so as to furnish a regular supply of food to the insects. The moth or flying weevil, which is so much a greater depredator on the crops of negligent farmers in lower Virginia, is not common in France, even if certainly existing there. Cleanliness in barns and granaries—cleaning out all the old grain, and all the grain some part of every year, is the best preventive against the black weevil. And the flying weevil, though even a more formidable foe, usually may be perfectly guarded against by care and attention, with a proper knowledge of the habits and especially the mode of propagation of the insect. See a long article on this subject at page 325, vol. i. Farmers' Register.—Ed. F. R.

GRASSES AND GRASS CULTURE OF FRANCE.—CONTINUED.

Translated from "Le Bon Jardinier," for the Farmers' Register.

Luzerne, Medicago sativa.—The great advantages of this plant, the most productive of all of those employed in artificial meadows, are well known. It prefers good land, deep, sound, well cleansed, and manured the year before it is sown; but it succeeds in many soils of different natures, but not on those which are grassy or have clay on the surface, or are very poor. If it is manured at the time of sowing it is necessary to do it with compost well pulverized. The considerable product and the great durability of lucerne, owing very much to the facility with which the roots penetrate the earth to a great depth, should have the effect of bringing it into universal cultivation. In situations that are either low or near woods, or that are from some cause subject to late frosts, it is prudent not to sow it until May. In some cantons it is not uncommon to see it postponed until the summer. In dry and light lands it may be sown early in the autumn with barley or rye. The ground having been well prepared the seed should be sown with that care which their fineness renders necessary. To keep up the product of a lucerne field, and to prolong its durability, it is proper to top-dress it in the winter, or in the commencement of spring, with well decomposed manure or with the ashes of turf or coal, or what is still better, with ground plaster, a substance which produces on all plants of the leguminous family the most astonishing effects. Plaster should be sown in a spell of damp weather when there is a prospect for rain; it may be done not only in the latter part of winter, before vegetation has commenced, but also in the spring and summer when the first and second growths have begun to be developed. Few persons are ignorant of the frequent accidents that occur from grazing the aftermath of clover and lucerne; when cattle are permitted to go on it before the dew has been dissipated, or after a rain, they become inflated, and often perish. Farmers, therefore, cannot be too careful in this respect, as well as in employing it green in the stables; for if given there whilst wet, or in too great quantities, it will occasion similar accidents. They sow forty pounds of seed per hectare.

Luzerne rustique, Medicago media.—There grows naturally in France a lucerne similar to the cultivated species, but which differs from it in its disposition to elevate its stalks and to grow more erect, and in its being more tardy to put out in the spring. This is the variety which I here call the luzerne rustique. From many observations that have been communicated to me, and from those which I have made myself, I have reason to believe that it is more hardy and less difficult to suit with a proper soil than the *medicago sativa*. It is very vigorous, and often produces stalks more than four feet in length. Athough the experiments that I have made are not sufficiently advanced for me to form any certain opinion, yet this plant appears to me to possess sufficient interest, to render it my duty to point it out to farmers, and to call their attention to it. It is an intermediate between the common lucerne and the *Lucerne faucille*, (*Medicago falcata,*) and I think, without being certain, that it is the plant designated by Persoon, in the Synopsis Plantarum, as the *Medicago media*. The *Luzerne faucille*, the culture of which has been frequently recommended, has always, in the attempts that I have made, appeared very inferior to the variety of which I write; but as it grows naturally on the poorest lands, it deserves to be submitted to the proof of culture. After continued attempts for many years I have determined to give up entirely the luzerne faucille. Although it grows naturally on poor chalk lands, yet sown on these same lands, the plants near one another do not grow with any of that vigor that they possessed when growing isolated here and there. Another objection is, that the stalks have a decided tendency to lie upon the ground. Finally, to obtain any decided profit from it on poor land, it is necessary to ameliorate it very much; in which case the medicago sativa is far preferable. Although the *Luzerne rustique* succeeded with me, yet it did not

seem to possess the decided advantages of the ordinary variety. But Mons. Descolombiers, who has also brought it into cultivation, informs me that with him it "grows vigorously, dry, and not deep, and not watered, in the midst of a crop of *brome* and yarrow; and, in short, that it most justly deserves its name," (the hardy lucerne.)

Lotier Corniculé, Lotus corniculatus.—Little is as yet known of the culture of this lotus, but it certainly deserves to be studied. In meadows, where it is frequently found, it is valued; although, from the shortness of its stalks, hay cannot be made of it. It is good for pasturage, grows readily in dry lands, and maintains its vegetation during the summer. It is suitable for most purposes for which the white clover is employed, and is often preferable, particularly in adorning grass plats, where its yellow flowers have a very pleasing effect. Unfortunately there are so few seed, and they are so difficult to collect, that the culture can never be widely extended.

Lotier velu, Lotus villosus.—This species resembles the last so closely, that many botanists have looked upon it as only a variety, but it is a decidedly distinct species. It will grow on lands more moist, is more erect, and is better supplied with leaves. From its great longevity, which I have observed both in its wild state and in experiments that I have made, I have no doubt that the *Lotus villosus* would be a good plant to cultivate, alone perhaps, but at least in mixtures, to form natural meadows. The grain is much more abundant than in the other variety. It should be sown in March and April, about sixteen pounds to the hectare.

Lupin blanc, Lupinus alba. It is only in the south of France and in Italy that the excellence of the manure that this plant affords, when turned under whilst in flower, is known. The grain soaked in water is a good food for cattle, and it is used when green as pasture for sheep. One of the chief advantages of the lupin is that it prospers on very poor land, such as a coarse sand, a ferruginous soil, or a poor clay, and affords means by which to enrich them; it is rather sensible to cold, and should not be sown in the climate of Paris until towards the middle of April.

Lupuline, Medicago lupulina, has the leaves and appearance of a clover, and for that reason is called sometimes *yellow clover*, or *black clover*, which names are derived, the first from the color of the flower, the last from that of the husk of the seed vessels. Its culture has for a great while been confined to the neighborhood of Boulogne, but it has been lately spread considerably, into the interior of France. It is valuable because it will grow on inferior lands. It is biennial, and can occupy in the cultivation of rye lands the same place that clover does on wheat lands. The forage that it affords is not abundant, but is fine and of good quality, and very acceptable to cattle. But the lupuline may be more advantageously used as pasturage for sheep than by converting it into hay. It is generally sown in March, at the rate of thirty pounds of seed per hectare.

Pois gris, Pisum arvense, as forage, is very much esteemed, particularly for sheep. It is an annual, and is of very rapid growth. It is good to sow on fallow lands, and if cultivated properly, it will reduce them into excellent order for the ensuing grain crop. Moist wheat lands are best suited to the Pois gris, but it will also succeed on rye lands when they are in tolerably good heart. It is well to manure it, when it is to be followed by a crop of grain. They usually sow it broadcast, and cut it sometimes when it is in full flower, but more generally when the most of the pods are formed, and dry it for winter use. Two spring varieties are the most common. One is early, and is sown in March; the other is not so forward, and is not sown until May. A third variety, called the *Pois gris d'hiver*, which is sown in the autumn, has lately been brought into cultivation, and seems to be very desirable, particularly in arid soils. Pois gris is put generally in those foragenous mixtures called *dragées*, (meslin or mixed grass.)

Sainfoin, Hedysarum onobrychis. The good qualities of the sainfoin are too well known to render it necessary for me to point them out; but I may insist with much utility on the faculty that this plant possesses of succeeding on indifferent lands, whether sandy and gravelly, or very chalky, and on its merit in ameliorating them very much. Among the examples of its ameliorating effects, I will mention that furnished me by Mons. Yvart, as having taken place on his farm, *Maisons*, near *Charentou;* he has with sainfoin converted into wheat lands fields of gravelly sand, from which he could previously, in spite of all his efforts, only obtain rye. The demonstration of these effects has been so plain, and the example so influential, that by degrees a great part of the lands of the plain of Maisons has by the same means undergone a similar transformation. When one lays out a meadow of sainfoin for mowing, and wishes to preserve its durability for as long a time as possible, the grazing the aftermath should be sedulously avoided, particularly in the first years. There are cases, particularly in indifferent ground, where they sow it expressly as pasturage for sheep; it will then last but a short time, but is still a great resource for food. They sow it generally in the spring, but sometimes in the autumn, and almost always with a grain crop. The variety, *Sainfoin a deux coupes*, or *Sainfoin chaud*, first propagated in the environs of Peronne, by Mons. Pincepré de Buire, has been considerably extended into France in a few years. It is more vigorous, is stronger and more productive than the ordinary sainfoin, and it yields a second abundant mowing, whilst the other only produces an indifferent aftermath. Many farmers who have adopted it have informed me that it required better land than the ordinary variety. As it is to be presumed that this is only a variety in some manner artificial, obtained by being cultivated for a great while in good lands, persons who sow it in indifferent lands should from time to time change their seed, to obtain constantly produce decidedly superior to the ordinary sainfoin. Its leaves being much larger, and harder, and the seed much coarser, it is necessary to sow it thicker. Mons. Tirris, proprietor at Forcalquier in the department of Lower Alps, has brought about an agricultural revolution, not only on domain, but in all the adjacent country, by the introduction of a grass that he calls the Spanish sainfoin, and which he believes to be the veritable *sulla.** But this plant, of which he sent me a

* See the *Annales d'Agriculture*, July, 1828.

few seed, has proved to be the *Sainfoin à deux coupes*, of which I have been writing. The real *Sainfoin d'Espagne*, *Hedysarum coronarium*, has not yet, I think, taken a place among our forage-nous plants, although it would probably succeed in our southern department.

Grand trèfle Normand.—Mons. de Laquesnerie, a learned agriculturist, discovered this variety of clover, and had the kindness to send me some seed of it. The experiments that I have made with it, have shown me how accurately he described to me the details of this plant. The Norman clover is much taller than the common trefoil, and generally yields but one crop, which, however, is often equal to two mowings of the ordinary clover, its hay is coarser, and the plant appears to be more durable. Is this clover to be preferred to the ordinary variety? I will not undertake to resolve this question, which indeed may be susceptible of different solutions, in different soils and under different circumstances. It has been so recently introduced, that it is impossible for me to form a correct opinion as to its value, but I have thought proper to point it out to farmers as an interesting subject for experiments and observations.

Trèfle d'Argorie, is another variety of red clover, which has been for some years cultivated in Switzerland, and which appears to possess some important qualities. I have been assured that it will last for four or five years, from which character it has been called the perpetual clover. I have not myself been yet able to verify this fact, but what I have observed in it, and what appears to me still more interesting, is the very decided disposition that it has to increase its stalks, and that it is at least fifteen days more forward than the common variety of clover. It is also very vigorous, and has long leaves. If the qualities which have shown themselves in this instance, in this variety, are confirmed by numerous proofs, and if it preserves them without any apparent depreciation, for many successive generations, it will be certainly a desirable acquisition to agriculture.

Trèfle incarnat, *Trifolium incarnatum*, affords only a single mowing, and its hay is inferior to that of the common clover; yet there are few varieties of the trefoil that can be rendered more serviceable in agriculture. Cultivated almost without expense, without care, and without deranging the order of the crops, it yields a most abundant crop of hay. It possesses, in a very eminent degree, the merit of being precocious; and, whether as pasturage or to be cut green, affords resources for feeding cattle before any other plant. They sow this clover in August, or early in September, generally on the stubble fields, after having turned them over by a light working with the plough or extirpator. This working, or rather moving the surface of the soil by repeated harrowings, is necessary for the clean seed, which it is necessary to cover with care. But when it is sown in the pug, it is sufficient to spread it on the stubble without any preparatory working, and to pass a roller over it. This is a very good plan, particularly when one wishes to sow it directly after harvest. One may perceive by this with what facility the agricultural condition of countries destitute of grass, particularly those where the triennial rotation is in use, could be ameliorated by the cultivation of this plant. Let a farmer for example sow a portion of his oat stubble, say a fourth part in it. About the first of May, if he wishes to cut it green, from the 15th to the 25th, if he wishes it for hay, all can be taken off, and he will then still have time to work it properly. Thus, without any derangement, he will have obtained from this part of his stubble field an abundant crop of hay between the harvest and the time for ploughing. The *Trifolium incarnatum* is very valuable to sow in places where the red clover is missing, which is done either by spreading on them the seed in the pug, or by raking in the clean seed. Almost all wheat and rye lands, provided they are sound, will produce this clover. I have sown much, and I have seen much sown on soils of very different natures, and with me it has only failed on lands that were excessively chalky, and that were very much spewed up by the frost. Sometimes our winters destroy this plant, but that accident is very rare, and although there is an instance of it in 1820, yet that should not prevent its culture from having a rapid progress. They sow thirty or forty pounds of the clear seed to the hectare, and when it is sown in the pug it requires from ninety to a hundred pounds.

Trèfle de molineri, *Trifolium molinerii.*—They designate by this name a wild trèfle incarnat, which grows commonly in the centre provinces, and in the north of France. It is chiefly distinguished from the cultivated variety, by the much paler color of its flowers, which are at first of a dingy white, and afterwards assume a pale red, or flesh-colored tint. But this difference, although general, is not constant, and although there are some other apparent differences, as the length of the heads of the flowers, &c., I do not know that they are sufficiently marked to permit these plants to be botanically separated. However, notwithstanding their close botanical conformity, there is a very decided difference in their dispositions, and in their mode of vegetating. First, the *Trifolium molinerii*, grows spontaneously in the north, where the other has only been introduced by culture; it is also slower in the germination of its seed and in its developement; it has less disposition to send forth stalks; and I have seen it last two years, whilst the *Trifolium incarnatum*, sown by the side of it on the same day, was entirely dead at the end of the first summer. That which first induced me to try the *molinerii*, and to compare the analogy of that and the *incarnatum*, was that, having often met with it about Paris, I thought that, accustomed for a long succession of generations to our climate, it would be more hardy, and resist more constantly the cold of our winters, than the southern race, and that the hay crop would thereby be rendered more certain. I have as yet obtained no decisive proof of this, and I should say, on the contrary, that it appears to me in many respects inferior to the cultivated variety. I have, however, thought it my duty to place before farmers this account of these experiments, because they have a really useful design. The *Trifolium incarnatum*, is a plant of so much value in agriculture, that it will be of great interest to our country to obtain a variety that will not suffer from cold. In a work recently published, the *Trifolium molinerii* and the *Trifolium incarnatum* are presented as being one

and the same. That may be true, botanically speaking, as I have said above, but in culture it is otherwise. I have cultivated the first for many years, and I have made comparative experiments with them both, of many acres at a time, and have always found decided differences between them. I am not singular in this opinion; many practical men, who have tried both of these plants, have come to the conclusion at which I had arrived. I will mention among them that distinguished agriculturist, Mons. Descolombiers, whose opinion on this subject coincides entirely with mine. A third variety has been announced and recommended, by Mons. Juery, of Toulouse, it is the *Tréfle incarnat tardif.* Its name indicates its quality; it is sown and cultivated like the common variety, and comes in later. According to accounts published at Toulouse, this clover does not commence to flower until the other variety is out of bloom. But in the experiments that I have made, both in the environs of Paris, and at Gatinais, I have found only the difference of five or six days in the blooming of the two varieties. Perhaps I may not have received the decided species, or this difference may be owing to the difference of the climate, which has more effect on the early than on the later variety. Be that as it may, the culture of it has made considerable progress in the south. Mons. Descolombiers, has informed me that in the department of Allier, he and his brother-in-law, Mons. the Marquis Saint George, have sown much of it, and have derived positive advantages from it. If one is obliged to resow, with the tréfle incarnat, a clover field that is too thin, this late variety should be very much preferred, as it accommodates itself better to the mowing of the red clover, than the ordinary variety.

Vesce commune, Vicia sativa, is an excellent annual forage, is suitable to render waste lands useful, and offers many other considerable advantages; the most important of which is that it may be seen as late as June on strong and moist land, and in that manner affords an opportunity of providing against a scarcity of hay, if the crop in the meadows should fail. There are two main varieties of tare, that of the spring, which is sown in March, April or May, and sometimes in June, and that of the winter, which is sown in the autumn. Both prefer good land, which is rather stiff than light. A considerable quantity of moisture in the winter will destroy the winter tare; it will grow more readily on dry and light soils than the spring tare, which, on the contrary, delights in moisture, particularly when sown late. It is necessary to cover the seed with care, to protect them from the pigeons, which are very fond of it. They cut the hay whilst the plant is in blossom, or when a part of the pods have commenced to die, or indeed after their entire maturity, if one desires the grain rather than the hay. The tare is a very good food to give green in the stable or to graze, but it should be used with the precautions that are necessary to be taken with all grasses that are very succulent and nutritious; for given too damp and too abundantly, it affects the cattle not less dangerously than clover that is too moist. The ordinary quantity of seed that is used is about 26 decalitres per hectare. It is well to sow a little oats or rye with the tares to support them.

La Vesce blanche, Vicia sativa alba, is less common than the two preceding varieties, but it is just as valuable as forage, and in addition, its white and larger grain affords a means of subsistence to man. In many cantons the inhabitants use it to make pea-soup, or use its flour in their bread, mixing it in small proportions with wheat flour. Many other varieties of tare might be usefully cultivated.

Ajonc, Ulex Europeus, Furze, is an extremely thorny shrub, a native of the uncultivated lands of Europe. The abundance and the durability of its yellow leguminous flowers would render it an appropriate ornament for pleasure grounds, did not the sharp and hard thorns at the ends of the branches and leaves render it objectionable. It is very good for making inclosures, which are almost impenetrable, for which purpose, after having sown it on the sides of ditches in March, they protect its young shoots from the attacks of cows and horses, which will eat it with great eagerness; which circumstance first led to the cultivation of the furze, in districts which were destitute of meadows and artificial pastures. They sow about 30 pounds of seed per hectare, on indifferent, but well worked land, the second year they begin to cut the young shoots before the blooming of the plant, which takes place from January to March, after that year they cut it in the winter as they require it. They give it to the cattle, after having crushed the thorns under a mallet or a stone. This plant has also the advantage of furnishing very good fuel, and they grow it expressly for that purpose in a part of Normandy. The furze is said to be a fertilizer. They get very good crops of wheat after it, which is owing without doubt to the custom of burning the stumps and roots, on the land when they extirpate it. The small variety of furze, *Ulex nanus*, common about the environs of Paris, serves whilst it is young to nourish the cattle of the poor, and in the autumn furnishes them with the means of heating their ovens.

Lenthille à une fleur, Ervum monanthos, is cultivated in some parts of France, for its forage and its farinaceous grain. Without being very productive, it possesses qualities which render it valuable in some cases; for example, it succeeds in indifferent lands, where one can neither raise the tare on the pois gris. Its small and climbing stalks require the support of oats or rye, which must be sown with it. Its grain is used as that of the *lathyrus sativa* in making pea-soup. They have made great use of it for many years about the environs of Orleans, where it is cultivated under the incorrect name of *lathyrus cicera.* It is generally sown in the autumn, and stands the winter very well. I have for many years been acquainted with the value of this plant, both from the experiments that I myself have made, and from those of my enterprising neighbor, Mons. Valentin de Culloin, which are on a very large scale. The masses of forage that he has obtained from the *Ervum monanthos* and the *Pois gris*, on land that until then was thought to be incapable of producing a single truss of hay, are such as have already resulted in the immense amelioration of his farm. I cannot too earnestly urge upon farmers, who possess gravelly lands, and who are stinted in their forage, to introduce amongst them the culture of this plant, as I am

confident that they will derive very great advantages from it. I say gravelly lands, because on those of an indifferent chalky nature, on which I have tried it, it succeeds but poorly.

Ers Ervillier, Ervum Ervillia, is an annual, and is common in some of our southern departments. The vetch, without being tall, affords very good hay, and also produces a large quantity of grain, which is given to pigeons, but with care, as it is very heating. The hay participates largely of this quality, and should be given in very small quantities to horses, and only when one wishes to give them ardor, or to prepare them to undergo very severe work. I have been assured that this plant eaten green by hogs was certain death to them. The grain as food for man is also suspected, and persons should guard against the mixing it in meal for bread. One may see that I wish less to recommend this plant, than to warn persons against the danger of it, of which they may be ignorant. The vetch can be sown in the autumn but it will succeed better when sown in the spring. Turned under in flower, it is thought in some cantons to be the most efficacious of all vegetable manures.

Féverolle, Faba vulgaris equina.—The great utility of this bean is generally known. Its culture may be very much ameliorated in stiff and clay soils, where indeed it is but little known. It affords a good forage, whether cut when in flower or when the pods have been formed. They often use it in the composition of *dragées* and of *hivernages* (mixtures of leguminous grasses, and oats or rye, intended for green food,) but it is the grain which renders it most valuable. They sow the féverolle from the first of March to the middle of April, either broadcast or in rows; the last method is generally preferable, but especially when the soil is compact, when working is almost unnecessary for the plants. The cultivation of the bean crop is desirable, not only because it is one of the least exacting crops, but because it is the best of all preparations for wheat on clayey soils. Turned under whilst green, the bean is one of the very best of vegetable manures.* All of the varieties, of which there are many, can be useful in farming; but this particular variety is the best for turning in. The *highland bean*, which I obtained from England, where it is much esteemed, is very valuable on account of its productiveness. In the south of France, the bean stands the winter very well, and is very often sown in the autumn, but in the north, where the ordinary variety is destroyed by the cold, or at the least very much injured, they sow a variety which is more hardy, and which they call the *Féverolle d'hiver.*

Rue de chevre, Galega officinalis. Those who see the rue in gardens, where its bunches are so vigorous and thrifty would conceive a favorable idea of it and desire to try it on an artificial meadow. But although recommended in many works, it unfortunately appears from different experiments that this grass does not suit cattle, because they refuse to take it as hay, and will not eat it in the pastures. If no positive experiments have been made on this subject, (and I know of none that have been made,) it is desirable that they should be made, as it is known that cattle often at first will refuse food that is excellent for them, and will become very fond of it after many trials. If such should be the case with the rue, it would be valuable on account of its great vigor its considerable product and its remarkable durability. They sow about 40 pounds of seed per hectare.

Gesse cultivée, Lathyrus sativus, is an excellent animal forage. It is particularly fine for sheep, and is less heating than the vetch. It succeeds readily on lands either stiff or light, if they are quite moist. They sow it in March and April, and sometimes, in the south of France, in the autumn. They cut it either when it is in bloom, and feed it green, or after the first pods have commenced to die, and make hay of it, or they permit it to mature entirely, that they may obtain the grain. In many parts of France the inhabitants make very good pea-soup of it.

Gesse velue, Lathyrus hirsutus. Mons. the Baron de Wal, of Baronville near Givet, informed me of the success which he had with this plant as forage. Sown in the autumn it appeared to him to rank in utility with the winter vetch. I tried it, at his request, and find it very hardy and foragenous, but more backward than the vetch. It produces a considerable quantity of seed, smaller than those of the vetch, but which appear to be good food for pigeons, but when the forage is cut green, as it ought to be, the most of the seed remain in the pods. If this plant could be brought into the list of those that are to be cultivated usefully for cattle, it would be a great conquest over the useless weeds of our fields, for the *Lathyrus hirsutus* is nothing else at present.

Petite gesse, Lathyrus cicera, is a winter variety, and is as hardy and perhaps more hardy than the winter tare. It furnishes an excellent food for sheep, but is too heating for horses, and should be given to them only with great care. I should also say that its grain is an extremely dangerous food for human beings. In some cantons the people make meal of it to mix with other flour, in very small portions, for bread. It does not appear to produce any bad effect, if the proportion is very small; but in years of scarcity some persons having increased the proportion, some have died and others have been stricken by an incurable paralysis. I have been assured of this by the excellent and indisputable evidence of the late Mons. de la None, surgeon at Bourqueil, and it has been confirmed by Mons. Deslandes in an article published in the Journal des Maires. It is particularly necessary to give this fact publicity, as the culture of the *Lathyrus cicera* has extended very much in France within a few years, and this danger has consequently increased.

(I have extended this translation beyond my usual length, that I might send you all of the article on "Fourrages légumineux," at once. Red and white clover, and melilot, which came under the same head, I sent you in my first selection.)

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* This fact, which is equally applicable to the various peas of this country, is, I think, well worthy of the consideration of Virginia farmers, who would, I feel confident, find it very much to their advantage to adopt this mode of using the pea, particularly as it grows with so much certainty and vigor, even on inferior land.

CORN CULTURE. BOOK FARMING. ORCHARD GRASS.

For the Farmers' Register.

I have derived much benefit, in the cultivation of my corn crop, by the use of the coulter plough recommended by Mr. J. M. Garnett, in one of the volumes of the Farmers' Register.

After the ground is flushed, and reduced by the drag log, I chequer it with the coulter plough, running as deep as I can with two strong horses. To mark the spot for the corn to be dropped, I have attached to the beam behind the coulter a small ploughshare. When the corn rises, I run the coulter plough deep on each side; and after thinning, I run the coulter plough through it one way, and cross with rank cultivators. This I repeat, alternating the ploughs and the cultivators, till I complete the cultivation. If the season be very moist and the grass becomes strong, I make the last ploughing with mould-board ploughs. This I do with some reluctance, as I am unwilling to turn the ground after flushing. I do but little with the hoe, and think but little is necessary. I am sometimes obliged to chop a rough bottom. In my neighborhood we had a continuing drought, from the middle of June to the first of August last year. The fostering rains which then fell restored verdure to the stalk of the corn, though many of the blades were entirely destroyed, and I made a good crop. The main cause, I think, was the deep shooting of the roots, by which they escaped the burning influence of the sun, during the continued drought.

I am a friend to book farming, founded on fact and experience: in proof I offer my steady adherence to the Farmers' Register. The philosophers are now pushing their theories to a great extent, and I think are disposed to mix too much chemistry with agriculture. I am by no means satisfied that the fertility of the glades, in the Alleghany mountains, is occasioned, even in part, from the evaporations of the Atlantic and Pacific oceans. I particularly distrust the philosophy of the German school, both moral and natural.

To those who are disposed to grow orchard grass, I would observe, that the crop often fails from defective seed. Those who supply the seed stores often desire to have the benefit of the hay and the seed, and gather it in its immature state. To get good seed the plant ought to be perfectly ripe, so as to serve for nothing but litter. A small piece of ground will produce much seed; from less than an acre and a half I last year gathered near forty bushels. If good seed be sown, either in March or September, it rarely fails.

I commenced my grass culture with eight acres, which I have extended to forty. The profit I think greater than I could derive from grain crops, on the same lands. I have an annual crop, and the only expense, cutting and saving the hay. The orchard grass which I sowed ten years ago is now running out, and has been followed by green grass, (Poa pratensis.) I cut a good crop of hay from it last year, and the aftermath resists the frost as well as orchard grass. My milch cows, with no other food, except when snow was on the ground, grazed on it till the 10th of December, without failing in their milk.

RUSTICUS.

Eastern Shore, Md., March 13, 1842.

DEBATE IN THE HOUSE OF DELEGATES ON THE BOARD OF AGRICULTURE.

From the Richmond Enquirer.

When the bill to provide for paying the expenses of the members of the Board of Agriculture came up on its third reading—

Mr. Strother offered a ryder providing that they should be paid for their past services, but that hereafter the Board should be abolished. He addressed the House at some length in opposition to the Board, and denied that any great focus of light would result from its labors. Who, he asked, were to constitute the Board? gentlemen, politicians, or farmers? If politicians were to form it, surely no value would result; and if farmers, what information would they convey which could not be obtained in another way? The Board met a short time since in this city, and informed us that they had turned their attention to the geology of the state and several other matters connected with its agriculture. Their first demonstration, however, was that they wanted their pay. Now, he took the position, that the information which the Board of Agriculture was designed to collect, could be obtained in a more tangible form from other sources. It was true, that the people were anxious on the subject of agriculture; yet they could gather from the papers all they desired to know, all that was useful, and all that the Board would be able to furnish. If the members of the Board would hide their light under a bushel unless appointed, if their wisdom would depart from earth with them, there would be some reason for putting them on this Board and paying them for giving it to the world. But not so, the agricultural papers were in the habit of receiving all the benefits of the information possessed by these gentlemen.

Mr. Kennedy was sorry to witness so much opposition to the measure now before the House. Especially did he regret the source whence it came. From his knowledge of the gentleman from Rappahannock, (Mr. Strother,) and that gentleman's known exemption from all that was illiberal or contracted, he had relied on him to sustain the measure. The objection urged against the measure was that it would do no good. Now, Mr. K. thought that it must be manifest to all who would take the trouble to examine into the matter. The operation of the Board was plain. It gave a stimulus and encouragement to county societies, and they afforded the means of obtaining information for the press, which re-acted on the people at large. The press, Mr. K. said, had done much, and had manifested a lively zeal in the cause of agriculture. Still, it had over and over again declared that knowledge was not to be acquired in so effectual a manner as through a report from a Board of Agriculture.

Last year a State Board was appointed. Recently it met here, not so much to give to the world the facts it had collected, as to organize a plan of future operations. They propose to establish a correspondence with every section of the state, with gentlemen of information and experience—each man giving the experience of himself and neighbors. By reference to similar boards in other states, some idea might be formed of the utility of which this one of ours would be productive. The books they had published contained

much valuable information. For the purpose of showing the benefit derived by a neighboring state, Mr. K. instanced the county of Washington, in Maryland—separated from his own county (Jefferson) only by the Potomac—a county possessing the same soil and advantages as Jefferson—exactly the same distance from market—and in fact no difference existing between the two, except that the taxes in Maryland are four times as high as in Virginia,—where land brought nearly $10 more per acre than it did in Jefferson. Nothing caused this but the system of cultivation, which resulted from the establishment of the Central Board of Agriculture.

Mr. K. said he could not let the occasion pass without expressing his deep regret, that Virginia should present such a spectacle, as she now did, of barren fields and deserted firesides. She had not improved with the time. She had not kept pace with her neighbors. She did not maintain her stand among the other members of the confederacy, and he greatly feared that she was losing the dignity of her position. It was only necessary to refer to her census and to her advertising journals, to perceive that her character, her talent and her wealth were fast leaving her and going to the prairies of the west. He appealed to gentlemen to do something to resuscitate the glory of the Old Dominion, and asked them if they were willing to stand by and see such a measure as this fall to the ground for the paltry consideration of two or three hundred dollars. On such a subject as this, he would not make an appeal to their sympathies, but to their liberality, to their sense of justice and to their intelligence.

Mr. Bayly regarded the ryder as incongruous. The bill provided for the future pay of the members of the Board, whilst the ryder repealed the bill itself. He should not vote for the ryder, though he might at a proper time be disposed to vote for abolishing the Board. After some remarks from Messrs. Strother and Bayly,

Mr. Leyburn addressed the House in support of the bill, and particularly in reply to the gentleman from Rappahannock, who, he said, seemed determined to kill the bill with hard riding —"head it or die." When he heard that gentleman denouncing this movement as a humbug, morus multicaulis as a humbug, all kinds of conventions, even the *Education* Convention as humbugs, he could not help coming to the conclusion that the gentleman himself had been a sufferer from the morus multicaulis mania. Gentlemen had said, that the papers would render sufficient aid to the cause of agriculture. Whilst Mr. Leyburn admitted their utility, he still contended that superior benefits would result from a Board of Agriculture, collecting information from every where, and affording that information to the press, to be condensed and placed in an attractive form before the people. All had heard of the American Almanac—a publication containing a vast number of important facts, and bought by multitudes of the people of the United States. Now, he thought that a Farmer's Almanac, such as they have in some of the states, gotten up by an enterprising man, and embodying the information derived from the labors of the Board of Agriculture, might succeed very well, and be of eminent service to the people.

Mr. Holladay said the question was now pending on the ryder, by which it was proposed to abolish the board. Last year, the board was established without pay—now, it was proposed to abolish it and pay its members for past services. This he considered singular. If the board ought to have been established, it should have been continued, and if so, it should be paid. He hoped gentlemen were not prepared to declare by their votes, that we were unwilling to do any thing for the cause of agriculture. Virginia was essentially an agricultural state. That was the main interest and occupation of her people. Was it not therefore our duty to do something for it? Were gentleman willing to say to the first, great, foremost interest, "we fold our arms and deny that we can aid you?" How, he asked, did the gentleman from Rappahannock (Mr. Strother) come to the conclusion, that no good would result from the establishment of this board? Did he go according to experience in his deductions? If so, where did he find proof of the inutility and inefficiency of such a board? Where was there a community, in which there was a board of agriculture, that had not improved in its soil and its agricultural productions? It was, he thought, vain to say that the propriety of the board was not demonstrated by experience. On the contrary, if we were guided by experience, why could not the same results be achieved here in our own state as elsewhere? Did our own experience show that no good had resulted?

Gentlemen had laid great stress upon the advantages to be derived from the agricultural papers. These journals were established by men who had given their attention to the subject, in its principles and details. They all coincided in declaring, that a board of agriculture should be established. As we had their advice to this effect, why not take it? The present board of agriculture was composed of men of high reputation and experience. They had testified strongly in favor of the advantages which would be derived from it. Did gentlemen here know better than they? Could they reasonably gainsay the opinion of these gentlemen, fortified as it was by facts and experience? They had no interest in the matter, but the high and holy motive of patriotism. They could derive no advantage from it whatever. They could gain nothing for their reputations, unless they did something for the state, by reforming her condition, and enhancing her agricultural interests.

The house had been told that they should be economical in expenditure. This board would cost $500 a year, but what was that compared with the benefit it was likely to confer upon the state at large? He (Mr. H.) was as much in favor of economy as any one here; still, he denounced as niggardly, the economy that would defeat a useful measure like this, for the sum of $500. He thought something should be done for an interest which paid so large a share of the taxes of the state. Let it not be said that nothing could be done for such an interest. Let an effort be made, and even if no good should result, we should have the consolation of knowing that we had made an effort for the cause.

Mr. H. again referred to the argument of the gentleman from Rappahannock, concerning the

agricultural papers, and contended that they, as had often been declared by their editors, were unable to collect the facts from the various sections of the commonwealth. To elicit the desired information from every neighborhood, the system of farming prevalent in each division of the state, to get at facts which the practical farmer will not come forward to give to the community himself, is essentially the design of a board of agriculture. The Legislature was in the habit of legislating for every interest and on all subjects. Yearly laws were enacted to take care of the terrapins, oysters, fish and wild-fowl of Virginia; *should it be said that we could and would do nothing for the great cause of agriculture?*

Mr. Crutchfield admitted the subject before the House was important, and a consumption of some little time in its discussion was excusable. He would, therefore, say a few words, though he despaired of carrying a majority with him in opposition to the measure. Agriculture, he admitted, was an important interest—the most important in the state—and if he could be convinced that it could be benefited by this measure, he should cheerfully go for it. As it was, he must call on his common sense to guide him in his conduct towards the propriety of it. He did not see why gentlemen should object to the ryder, by which the future operations of the board were to be discontinued. If so much benefit was to result from the board, why was it so slow to be perceived! Had not an effort to establish it been made year after year, and without success, until last winter, when it never could have passed, had provision been then made to pay its members? In former times, when there was a surplus in the treasury and when a majority of the legislators were farmers, all efforts to establish a board were useless. Last winter it passed without provision being made for pay, and without calling the ayes and noes. Years ago, the ayes and noes were always called successfully against it.

Mr. C. reminded gentlemen of the voluntary boards and societies which had been formed for agricultural purposes in different parts of the state. They had all flourished for a few years. There was one in Albemarle—where was it now? There was one in Spottsylvania, but it was waning away. These societies had given many speculative reports; yet Mr. C. said, that after a while they degenerated, and became like the reports of many of the school commissioners—a column appropriated for "remarks," and the whole of it blank, except the words, "nothing further since our last report." Mr. C. said he opposed the further continuance of the board, because he was convinced it would render no service to the state. Could he bring his mind to a different conclusion, poor as the treasury was, he would vote $500,000 to aid the cause. The proposition to pay the board for past services was a draft on the honor of the Legislature, which he could not consent to protest. He was willing to pay the board, and let it cease for the future.

Mr. Kinney said he was opposed to the ryder. The Legislature had done much for every other branch of knowledge but agriculture. It had established professorships of law, of medicine, and a military institute. Did the state of Virginia look now as she did formerly? We all knew her condition, and it was time that we should be awakened. We now saw the old commonwealth —once the first and foremost in the union—sinking lower and lower every day! Was it not time that we were tracing the cause of her decay, and if it were found to be her agricultural condition, to endeavor to revive that drooping interest? The proposition before the House was not new. It had been agitated for years. Several sessions ago, it was lost by the vote of one of the delegates from Albemarle, (Mr. Gilmer,) who thereby nearly lost his seat on this floor. The gentleman from Spottsylvania had referred to the Agricultural Societies in different parts of the state, and had supposed that like that in his county they were all declining or dead. He (Mr. K.) took pleasure in bearing his testimony to the benefits they had conferred, particularly those of Rockbridge and Albemarle (which, he said, was not dead, as the gentleman from Spottsylvania had stated,) with whose operations he was somewhat acquainted. As such good results had been compassed by county associations, he augured that farther and still more important advantages would be derived from a state institution.

Mr. K. said he would read from a valuable work which he held in his hand (the New England Farmer) to show what other states had done to promote the interests of Agriculture. In *Maine*, $70,000 was paid in one year for bounties on wheat. In *New York*, an appropriation of $120,000 was made to it. In *Indiana*, a Scientific and Agricultural College was established. In *Georgia*, a Board of Agriculture was incorporated. *Massachusetts* had encouraged it by causing an agricultural survey to be made, and by bounties on wheat, &c., *Maryland*, *Kentucky* and *Michigan* had all acted on the subject. *Maine* gave a bounty of 3 cents on cocoons, and 50 cents per pound on reeled silk; *Vermont* 10 cents, and *Pennsylvania* 20. Mr. K. then proceeded to speak of the culture of silk and the advantages which the state would derive by encouraging it. At present we imported largely from France, when we had a soil and slave labor which was peculiarly adapted to its cultivation.

Wherever, Mr. K. said, encouragement had been given by a state to agriculture, that state went ahead of its neighbors. He trusted, therefore, that gentlemen would not refuse this important interest the poor pittance of three or four hundred dollars.

Mr. Crutchfield said that the gentleman, who had just spoken, had referred to the prosperity of other states, and attributed it to the Boards of Agriculture. Now, he had often heard other gentlemen say that their prosperity was attributable to their internal improvements. This argument had been frequently used by the friends of internal improvement. Mr. C. said he was informed that there did actually exist at one time in this state a Board of Agriculture, with John Taylor at its head. That Board, thus constituted, was suffered to go down, when there was a full treasury. He would leave this fact with gentlemen to make their own application.

Mr. McRae protested against the ryder as incongruous and unfair. He trusted the House would vote down this insidious effort at the defeat of the bill. He bore his testimony to the advantages of an Agricultural Board, and of voluntary associations, as exemplified in his own county.

Mr. Strother coincided in the view, that agriculture was the most important interest in the commonwealth; yet, he contended that legislation had frequently been had indirectly for its benefit. What was the Geological Survey intended for, if not to benefit the interests of agriculture? That survey was carried on at great expense. Its object was to develope the agricultural resources of the state. Year after year, we had looked for something to grow out of it, and still the only fact that had been developed was that some oyster shells had been discovered on the Blue Ridge—a fact no doubt very interesting to the philosopher, but of no practical value to the farmer. The gentleman from Jefferson (Mr. Kennedy) had referred to the flourishing condition of Maryland and New York, and had attributed it to state encouragement of agriculture. Now he (Mr. S.) explained it thus: every man there had a direct interest in the soil (which was less in extent than ours) and is thereby induced to till it with more care. Here, a large portion of our labor has no permanent interest in the soil, and is therefore reckless as to the mode of cultivation. As to the allusion of the gentleman from Rockbridge (Mr. Leyburn) to his morus multicaulis speculations, he confessed he had suffered a little; yet he did not give full credence to the fallacy at the time so prevalent. He did not believe in the influence, which, it had been asserted, would come from the Board of Agriculture. He believed it would be as insufficient as the grand Geological Survey, from which so much was promised.

Mr. Taylor, of Loudoun, said, he had not intended to trouble the House with any remarks of his in opposition to the bill now under consideration; but many members near him expressed surprise that *he*, coming from a county distinguished for its success in agricultural pursuits, should be found in opposition to this bill. He felt it his duty to that great interest to oppose the bill now under consideration. He had been raised a farmer—a *practical* farmer, not a *book* farmer. In his opinion, it required no science and no reports from a Board of Agriculture to teach men how to handle the plough, the axe and maul. The best farmers in the world, Mr. T. said, were the plain people of Pennsylvania, who were in the constant habit of doing their own work.

Mr. Kincheloe took ground against the bill. He said the proceedings now had, in relation to the present bill, reminded him of the fact that there once existed a Board of Agriculture in the state. When that Board was established, there was no doubt the same display of eloquence in its behalf as now, and the same promises of large benefits that would result from its operation. That Board and its history might be cited as a case in point why the House should not sanction the continuance of the present. It was created with ten members, who received pay and mileage. It was continued for some years, until it was perceived that it did not answer the purposes for which it was intended, when it was abolished. Thus, the people lost about $50,000 in the experiment, before their eyes were opened. He (Mr. K.) was opposed to the bill, because he considered it would be of no practical utility or importance; yet, whilst he did oppose the measure, he declared himself to be a friend of agriculture, as the foundation and moving cause of every thing else.

Mr. Clendenin protested against the passage of the bill. It would cost 5 or $600 now, and yearly additions would be made to the expenses of the board. He therefore moved the indefinite postponement of the bill, and called for the ayes and noes on the motion.

Mr. Rives regarded the provisions of the bill, not in the light of a loan granted to agriculture, but as a *right* which that great and controlling interest might demand. Considerations of a wholly different nature from those which influenced the conduct of many gentlemen, should determine his course. He denied the dignity and consistency of the course proposed to be adopted in relation to this measure. Last winter the bill was, after a discussion, passed. Gentlemen had said, that it passed upon an understanding, that the members of the board were to receive no compensation. Had they looked to the evidence before they made the assertion? The gentleman from Spottsylvania, said it passed only on that condition. As to compensation, Mr. R. thought it was merely a matter which had been omitted in the bill establishing the board. The members had met and deliberated. Gentlemen declared they had done nothing. True—but, asked Mr. R., had they not taken incipient steps for obtaining a consummation which would redound to the honor and interest of the whole commonwealth?

Mr. R. then spoke of the impropriety and inconsistency of the course proposed to be adopted, by the ryder of the gentleman from Rappahannock. It was proposed to tell the members "you have done nothing—you have been of no service—still, we will pay and discharge you." Was it wise, dignified, or prudent to say this to those gentlemen; to destroy the board, and yet pay them a few dollars and cents? As honorable and high-minded men, would they receive the compensation tendered under such circumstances? Mr. R. asked gentlemen to pause before they abolished this board, and before they came to the conclusion that it could do no good.

Mr. McIlhaney said, he was unused to public speaking, but was sincerely devoted to the agricultural interest of the state. No man in the house excelled him in the zeal which he felt, and was ever ready to manifest, by his practice, for the *bone and sinew* of his country. He was emphatically a farmer in all his notions and feelings. He had been partly brought up to the plough. With all the care and attention of which he was capable, he had listened to the arguments and views of those who had advocated this measure. He had seen gentlemen of the bar, rise and theorise on farming with all their strength. Now, he could say, as to those gentlemen, that, if they expected their sons to be benefited by the theories of a board of agriculture, they were very much mistaken.

But, said Mr. M., the House has been told by the gentleman from Jefferson (Mr. Kennedy,) a man who was very near to his heart, that much good had resulted to the cause of agriculture by boards established in other states. He referred to Pennsylvania. He would accompany the gentleman in his investigations in that quarter, for he had visited that state and spent some time there;

it was to improve his knowledge and enlarge his views by inspecting the system of cultivation pursued by the farmers in that country. In that great and fertile valley extending from Philadelphia to Lancaster and Columbia, and thence to Little York, whom did he find to be the best and most successful farmers? who possessed the most highly improved lands, and most remarkable for economy? Those who have been brought up to the plough handle; those who trod their own soil, the honest, plain-spoken, hard working Germans, who never saw the printed report of an agricultural board. They taught me more in a day or two, than a board of agriculture could in a year. The German farmer affords an instructive example to any one who would seek to know how to carry on a well-cultivated farm—and this truth is strongly illustrated in the county which he had the honor in part to represent. Mr. M. said his people were economical in their principles and habits, and had clearly intimated to him to study economy in his votes. So long as he retained his senses, and knew what he was doing, he meant to do his duty, and carry out their wishes. If the scheme before the House was a good one, he would vote for it; but he did not so think. It might only cost $500 now, but hereafter, it would cost thousands without an equivalent. This small sum was the beginning—improvements of the scheme would be thought of, and more money demanded to carry it out. He should, therefore, vote against the bill, and hoped, if the learned lawyers who advocated it, wished their sons to acquire agricultural knowledge, they would encourage papers, friendly to the diffusion of information upon this subject, and bring them up to a practical knowledge of the plough and the scythe.

The question was then taken on the engrossment of the ryder, and decided in the negative.

Mr. Scott of Fauquier then addressed the House briefly, in support of the bill—after which it was passed—ayes 90, noes 34.

[The bill, as passed, was before published at page 138 of this volume of the Farmers' Register.—Ed. F. R.]

REMARKS ON THE LEGISLATIVE DEBATE ON THE BOARD OF AGRICULTURE.

We have reluctantly given the space it occupies to the debate on the bill for paying the Board of Agriculture. *Reluctantly*, we say, because, though the debate forms a large part of all the legislation of Virginia for the benefit of agriculture, and therefore has a right to a place in the Farmers' Register, we are really *ashamed* for Virginia, that the decision should turn on such facts and such arguments as are there displayed. We are not objecting to the course of any member of the legislature for opposing the establishment of a Board of Agriculture, nor for his voting against the last bill, because of such general opposition. Our most intimate associations were with some members who have been throughout thus opposed to the establishment, and to all legislation thereon; and in all our intercourse, we never uttered to one of them a word, in the hope of removing their objections, and still less would we have thought of blaming their decision. We can very well appreciate the objections of such opponents, when even *we* almost despair of any important service being rendered by the Board, discountenanced as it has been from the beginning, and treated with suspicion and contempt by the legislature; and without promise, or any yet visible appearance, of designed support and aiding labors from the agricultural class. It requires but little stretch of wisdom to infer, and to predict, that if left to rely upon their own exertions only, without aid and without sympathy from their fellow agriculturists, all the zeal and labors of mind and body of the members of the board will result in nothing, compared to its great objects, and to what might be the results of such an institution properly aided and sustained.

We object not, therefore, to the mere opposition of legislators to the bill, but to the manner of their opposition, and the ignorant flippancy exhibited in the debate. Mr. Strother condemns and ridicules the members, because in their first and only session they had communicated no important agricultural information: and he speaks contemptuously of them, because they so soon "wanted their pay." Now we should be glad to be informed *what* information could possibly have been expected from a board just met and organized, and which merely remained in session long enough to digest a plan for future operations, if enabled to act at all, by the aid of the legislature and the farmers of the country? If, instead of this course, the members of the Board had proceeded to put forth a report of their individual agricultural opinions, and had remained long enough in session to digest, write out, and submit the elaborate report to the legislature, would not Mr. Strother have been among the first and loudest to prefer against them the well-founded charges of foolish presumption, and of making a useless demand on the treasury, by such length of session? As to "their pay," it is very true that this subject occupied part of their report, and with good reason. Every man must know that there never could have been a second meeting of the Board, if the members were *again* expected to come, at their own expense, from the most remote regions of the state. It was therefore the duty of the Board frankly to state the existence of an obstacle which, if remaining, would certainly prevent any useful or continued action of the body; and which, if not removed, would render perfectly futile all efforts to carry into effect any plan of operations which might be prepared. It would have been but a ridiculous farce to digest and to start a general plan of procedure,

which could not by possibility proceed to fulfilment. And the men who submitted to accept the appointments, under such discouraging circumstances, (independent of subjecting themselves to the ridicule and contempt of such as Mr. Strother,) have already made, and are prepared to make sacrifices for the public good, of which Mr. Strother probably has no conception of the possibility.

Mr. Strother further charged, (without the least foundation of fact,) that the Board "informed us that they had turned their attention to the geology of the state;" and in a subsequent speech he charges as given to the encouragement of agriculture, all the large sum that has been thrown away on the geological survey of the state. He cannot think much worse of the manner of that expenditure and its results than we do; but it is utterly unfounded to charge it to agriculture. It has been emphatically *a job*—such as legislative bodies are easily persuaded by plausible and self-interested lobby members to allow for private benefit, under pretences of subserving the public good—and which, (the geological survey,) has been of not the slightest benefit to agriculture, and very little to any other *public* interest. Mr. Strother is welcome to refuse even to give the present estimated expenditure of $500 a-year to aid agricultural improvement; but we protest against his claiming that some $40,000 have been already applied to that object, because so much has been spent in the costly humbug termed a geological survey. If given to that bottomless pit, the James River canal, it would have been more profitably expended.

Mr. Crutchfield informs us that a Board of Agriculture formerly existed in this state, with John Taylor of Caroline at its head, and which, proving worthless, was suffered to go down. And Mr. Kincheloe adds to this newly discovered piece of history of agriculture in Virginia, that in the few years it continued in worthless (and since forgotten) existence, this Board cost, in pay and mileage of its members, some $50,000 to the people "before their eyes were opened." No correction or reply was offered to these statements, by any member, and therefore we presume that they were admitted as true. It is, however, the first intimation that we have had of such occurrences; and however hazardous it may be to assert a negative, and to deny the existence of legislative acts affirmed by legislators in debate, we will presume to express our confident belief that there is not one word of truth in the whole statement—that there never has been before a Board of Agriculture established by the state—and of course that John Taylor was not at its head—and that no such cost as $50,000, nor any other cost, was caused by any such establishment. Though not much conversant with laws or legislative proceedings, and therefore we may well be ignorant of many such matters, we remember some facts which we presume served for the entire material of which this old and forgotten "Board of Agriculture" was manufactured. There was once in existence an Agricultural Society of Virginia, over which John Taylor presided—which society asked and *was refused* legislative aid and bounty, for the improvement of agriculture. These facts, we infer, are the true original "something as black as a crow," which became "the three black crows," thrown up by Mr. Crutchfield and Mr. Kincheloe before the House of Delegates.

The results of all the labors and efforts of the Board of Agriculture may indeed prove to be as worthless, and their procedure as profitless to agriculture, and even as contemptible, as Mr. Strother has endeavored to make out. But whether so or otherwise, the Board, or its working members, will not the less have labored much more than is to be recompensed by "their pay." The full payment for the session of six working days, and travelling expenses, of the member who writes these comments, amounted (as understood from the law, for it has not been drawn,) to $22. And he is very confident that he has performed more labor than did most of the members of the legislature in six weeks of *their* session—and that his labors were as little directed by the consideration of the *per diem* allowance as those of any member of the legislature, whether voting for or against the repeal of the 90 days' limitation or "starvation law," of the late session.—Ed. F. R.

SHAD FISHERIES.

From the Philadelphia Ledger.

In your paper of the 31st March, you remark that "a large number of fishermen left the city yesterday for fishing, with shore nets. Shad may be expected in abundance, and the price greatly reduced. They are not allowed to fish for them (shad) but with gill nets, till the 1st of April."

In this latter clause you are in error. The laws for regulating the shad fisheries do not specify the time to begin operations with either description of seines, but do fix the period at which they shall cease, viz., on the 5th day of June.

The gill seines are, at this early stage of the season, fishing below where the Delaware and Pennsylvania line strikes the shore, and are of course out of the concurrent jurisdiction of Pennsylvania and New Jersey, and not amenable to the laws regulating their respective fisheries.

It is by thus assembling in the lower part of our river, to the number of several hundred nets, varying in length from fifty to near three hundred fathoms each, stretched directly across, and drifting with the current, breaking up and dispersing the shoals of shad, and confining them to the salt or brackish water, where they are compelled to

deposite their eggs, which are of course lost, instead of being allowed to reach the fresh waters whither their instinct directs them, that the great scarcity of shad, of late years, is wholly attributable. In the Connecticut and Delaware rivers, in the ratio of the increase of gill nets, the shad have decreased. On the Potomac river, on the other hand, where the gill nets are not allowed, but where the shore seines, in some instances, are nearly a thousand fathoms long, and where they commence fishing as early as they please, and fish as long as it is profitable, (Sundays *not* excepted,) the shad are as abundant as ever. Indeed they were never caught in greater numbers there than last spring. Such too was the case in the Delaware, until the gill nets were so greatly multiplied. Before this description of net was introduced here, the shore seines, then more numerous than now, supplied our city and the country adjacent to the river with abundance of shad, at an average price of from six to eight dollars the hundred—of late it has attained to twenty dollars the hundred.

That the gill seines do cause the shad to leave our river, may be proved by the fact, (related to me by a respectable and inteiligent old fisherman from Egg Harbor,) that a few years ago the shad entered our bay in great numbers; the gill nets met them early and far down, and took them in great quantities—when suddenly they became scarce, but in a very short time after made their appearance in the inlets along the Jersey coast. His conviction was, at that time, that, meeting with such obstructions, they abandoned the Delaware for other waters. This conclusion is borne out by a fact related to me only a few days since, by a gentleman once largely interested in the shad fishery, that in the early part of last spring, the shad ascended this river in considerable numbers, to where the gill seines obstructed the channel, and were taken in great numbers by them; that they soon, however, commenced a retrograde movement, the gill seines keeping pace with them. The inference is clear that they *too* left our river, inasmuch as but comparatively few reached the shore fisheries immediately above. Indeed, some of the latter, hitherto valuable, did not defray expenses.

So far is it from being probable that the price of shad will be "greatly reduced," the experience of every succeeding season, of late years, shows that it has risen with the decrease of the shad. Indeed, the predictions made by experienced fishermen, when the gill nets were first introduced, that shad, in consequence of them, would soon become as scarce in the Delaware as salmon were in the Connecticut river, seem likely to be verified.

S.

CAUSE OF PHYSICAL DEGENERACY.

From the Maine Farmer.

The question was asked in the Farmer a long time since, "What are the causes of the deteriotion of the human race for the last fifty years in America?" I have never seen it answered to my entire satisfaction. Undoubtedly a number of things have or might have had a bearing on the subject, but if animal life consists in the effect of stimuli operating on what may be stimulated, then it seems that an exact proportion of stimuli to excitement, excitability, or what may be stimulated, would be perfect health, (if such a thing ever was.) I know that too much stimulating food and drink, if the above principles are sound, would produce just what we see has taken place. Our diet has been too much animal food, and particularly that which is oily. Destroy digestion in any animal and you belittle him. The use of tea and coffee in the room of milk, and the several kinds of mixtures that used to be made from milk, is another cause. Provoking the appetite by the modern art of cooking with too great a variety, to eat too much, is another cause. As I have before said, destroy digestion, and you belittle any race. Hard grain given to young colts has done it, and produced lasting disease through life. Very high keep in pigs, and a confined life, will and has done it in that race. Rum will destroy the growth of a puppy—and the deleterious effects of ardent spirits upon the human system are, alas! too plainly apparent. I will also mention a lack of exercise in the open air, among the causes of degeneracy. This is best obtained by *actual labor*.

In order to renew our race, let us return to the diet, exercise and habits of our forefathers of the revolution.

I do not pretend that I have done the subject justice. I merely submit the above as a few, what I call, common sense thoughts.

NOT A PHYSICIAN, BUT AN
OLD-FASHIONED FARMER.

URINE.

(From Squarey's Treatise on Agricultural Chemistry.)

"When it is considered," says Liebig, "that with every pint of urine, a pound of wheat might be produced; the indifference with which this liquid excrement has been regarded is quite incomprehensible."

We can here only join in expressing our surprise at such neglect; but we would at the same time fain hope that such neglect has arisen entirely from ignorance of its value, and in the zealous endeavors that are now making by agriculturists at large, and the zeal, energy, and ability that is now displayed, we may fairly anticipate a juster appreciation of this manure for the future.

That we do not overrate the value of this manure, may be proved from the following results of the analysis of 100 parts of wheat manured in different ways, and which places human urine in the very first place as to value.

We have before stated that the weight and value of wheat as an article of food, depends on the quantity of gluten it contains, and this fact admitted, no other argument is required to convince us of the superiority of urine as a manure:*

100 parts of wheat manured with

	Gluten.	Starch.
Human urine (dried) yielded	35.1	39.1
Bullock's blood (dried)	34.2	41.3
Human fæces (dried)	33.1	41.4
Sheep's dung	22.9	42.8
Pigeon's dung	12.2	63.2
Cow's dung	12.0	63.3
Vegetable Humus	9.6	55.9
The same soil not manured	9.2	66.7

* Analysis of Hermbstoedt, quoted by Professor Dauberry.

We have elsewhere endeavored to show, that all excrement partakes of the nature of the food; that if food, consisting almost wholly of nitrogen, is consumed, that such excrement will principally consist of the nitrogen not required to supply the waste of the body. That if food principally consists of substances in which carbon predominates, that the matter voided as excrement neither is nor can be so rich in nitrogen as in the preceding case: the rule holds good throughout all creation; and therefore, as man is a carnivorous animal, and lives in great measure on the flesh of animals, a substance almost entirely composed of nitrogen, human urine is much richer in this substance, nitrogen, than in animals living exclusively on vegetables. The analysis of these matters accordingly proves that human urine contains four times more fertilizing matter than the urine of horses, cows, and sheep.

In all the remarks then that follow, we must be considered as speaking of human urine; but the same arguments will apply to the urine of all animals, only in lesser proportion.

And it must be again repeated that the liquid excrement of all animals is infinitely to be preferred as a fertilizer to the solid excrement, the urine in all cases containing all the soluble salts which are thrown off from the body as waste matter; such as the ammoniacal salts, the phosphates or soda, potash, and magnesia, the substances which are now recognized as constituting the ingredients of all kinds of grain, and which are essential both to their growth and developement, and for supplying the nutritive matter of the grain.

Berzelius gives, as the contents of one thousand parts of human urine in his elaborate analysis of the fluids,

	Parts.
Urea	30
Lactate of ammonia and animal matter	17¼
Uric acid	1
Sulphate of potash	3¾
Sulphate of soda	3¾
Phosphate of soda	3
Phosphate of ammonia	1½
Chloride of sodium	4½
Muriate of ammonia	1½
Phosphate of magnesia and lime	1
Water, mucus, and silex	933

"If from the above analysis, we take the urea, lactate of ammonia, uric acid, the phosphate and muriate of ammonia, one per cent. of solid matter remains, consisting of ammoniacal salts, which must possess the same action, whether they are brought on a field dissolved in water or urine," Hence the powerful influence of urine must consist in its ammoniacal salts. Now, when urine is allowed spontaneously to putrefy, one portion of the ammonia unites with the lactic acid to form lactate of ammonia, and another becomes volatile in the state of carbonate of ammonia.

The formation of this carbonate of ammonia entirely alters the state of the urine, rendering it an alkali, instead of an acid, which it is in its natural state; and this explains why putrefied urine is to be preferred as a manure to urine in its fresh state. Now the great object is to fix this carbonate of ammonia, or at all events the ammonia, in the soil.

If the urine is applied as a manure in this state, that is, with the lactate and carbonate of ammonia in solution; the latter salt, from being volatile, will evaporate with the watery parts of the fluid; and the loss which would accrue from this mode of using it, would amount to nearly one-half of the weight of the urine employed. So that, if by any means we can fix the ammonia, that is, deprive it of its power to fly off with the evaporation of the watery parts of the urine, we shall increase its action twofold. This object may be effected in a variety of ways. If a field is strewed with fresh burnt gypsum (sulphate of lime) and then the putrefied urine be applied on its surface, the gypsum will absorb and decompose the carbonate of ammonia, and the carbonic acid gas thus disengaged, will unite with the lime to form carbonate of lime, and the sulphuric acid of the lime will unite with the ammonia to form sulphate of ammonia and this salt will remain in the soil and not be volatilized.

But a simpler way still is to mix the gypsum with the putrefied urine, and thus effect the double decomposition above described before distributing it on the soil.

The quantity necessary will of course depend on the quantity of carbonate of ammonia the urine may contain, and this not only varies with every stage of putrefaction, but depends also on the way in which it has been kept; and again on the quality of the urine itself, no very definite quantity therefore can be named. But an easy way of knowing how much gypsum to put to a certain quantity of urine is to add it constantly at intervals of a few hours (taking care to stir the mixture well occasionally) as long as any volatile smell, similar to hartshorn, escapes, the absence of which will be a sure test that the ammonia has lost its volatile property, and has become, to use a chemical and expressive term, fixed.

Chloride of lime may be used for the like purpose, but being more expensive than the gypsum, it would not of course be resorted to.

Dried peat, tanners' bark, sawdust, turf and other similar substances, may be also used for this purpose, but the gypsum is decidedly preferable.

Sulphuric acid, the oil of vitriol of commerce, may also be advantageously used to fix this salt, and to do so, nothing more is necessary than to mix a sufficient quantity of this acid with the putrefied urine, until almost all effervescence ceases, keeping it well stirred during the whole of the time, and taking care not to add an excess of acid. In this case the ammonia unites at once with the sulphuric acid, to form the sulphate of ammonia; and the carbon being disengaged, escapes in the state of a gas.

Other means might be used to effect the same results as we have here demonstrated; but it is needless to specify them, as those we have already detailed combine great facility as well as extreme cheapness.

Having thus specified the change that takes place in the state of urine, the best manner for converting the ammonia for the purpose of agriculture, we shall suggest the best means of practically using this manure on a farm.

The first thing necessary is to procure a supply of urine. But if due care is used to save all that is now wasted, no farm need be in want of it.

The supply being obtained, it should be placed in large casks or tanks under cover, until the vo-

latile smell of the ammonia indicates that decomposition has taken place. When this occurs, it may be either poured over a heap of compost, consisting of coal ashes, charcoal or gypsum, in any proportions that are the most conveniently obtained, and then allowed to dry by frequently turning the heap. Care being taken, that if any volatile smell occurs, during this process of drying, that more gypsum be at once added. The volatile ammonia will in this operation be absorbed by the gypsum, and converted into a sulphate of ammonia, and other parts will be absorbed in the gaseous state by the charcoal and the ashes; but all will at once be yielded up to the first moisture that may come in contact with the heap; and therefore, it may be very properly classed amongst those fertilizers which act as a stimulus to the plant. We would, therefore, reasoning from analogy, suggest the use of this dried compost, as an excellent substitute for bones in the drill in sowing turnips. And we are further confirmed in this opinion, from the fact, that the new manure, the urate, only lately introduced, and which is presumed to be prepared somewhat in this way, has been found to answer admirably for the purpose intended. The addition, however, of a phosphate of lime, would increase its value in this respect, and render it undoubtedly more valuable than bones for this purpose.

Another compost heap, which would answer admirably for any purpose almost for which a manure can be required, that is, either as a stimulant for turnips, as a pabulum for wheat, or white crops —or, again, as a top-dressing for either of the above, or for grass—may be readily formed by mixing long stable litter, in which decay has already commenced, with the burnt ashes of vegetables or wood, in somewhat indefinite portions; taking care, however, that the litter should predominate, and then pouring over the heap daily a portion of the putrid urine, and stirring the mass well up together.

In this heap the ammonia of the urine would be decomposed; but the nitrogen, the vivifying principle of the ammonia, would unite with the alkaline matter, the soda or potash of the burnt vegetable ashes, to form nitrate of potash or soda: the hydrogen, the other constituent of ammonia, being given off.

After what has already been said about the utility of these salts as fertilizers, it will be needless to add more here, than earnestly to recommend every agriculturist to adopt these simple means for the production of two manures, which in value to the farmer cannot be surpassed—both for the facility and economy with which they may be prepared, and which would by their fertilizing properties confer a benefit not only on the farmer, but on the community at large.

It may be urged as an objection, that in many localities, far distant from towns and cities, this manure could not be obtained in sufficient quantities to supply the place of other substances more readily obtained. To this objection we would beg to suggest, that if ever a demand for this article exists, means will be taken to secure a supply; and, that in such a case as above supposed, the farmer's wagon would be enabled to load back from the town or market where their produce must eventually be consumed, with this matter. And further, they may commence with the supply that is always to be had to some extent on their own farms, and thus verify the results here predicted.

We will only add, that the urine of one man, taken at its lowest calculation, will produce in one year, a sufficient supply of nitrogen for the formation of 800 pounds of wheat, or 900 pounds of barley; a fact of sufficient importance, it is hoped, to induce a trial at least—and this trial fairly made, we have no doubt of the result.

Indeed, if all the human excrement, now worse than wasted, were applied to the purposes of agriculture, animal manure might be entirely dispensed with. But if we look at the subject on an extended scale, and see the thousands of acres now barely cultivated at all, but all of which only require manure to be applied to them, to enable them to yield abundant crops; and if we reflect on the benefits all must derive from such an increase to the real wealth of the country, as the cultivation of these lands would induce; and further, that the increased means thus afforded, would as certainly induce an increased population, which again in their turn, acting fully up to this system, would again prove another source of wealth and strength to the community—we may be enabled to estimate in some slight measure, the order and arrangement that exists in nature, for the support of all her creatures; and that it is the neglect of those means, which providence in its wisdom has placed at the service of man, and not any imperfection in the grand scheme of the creation, which has induced the impious belief by some, that a redundant population may be a curse instead of a blessing.

But to return more immediately to our subject. Enough has been said to show that ample means exist for bringing all the waste lands gradually into cultivation; that we have the power, if we have the inclination, to do so. And the circumstances of an increase, and rapidly increasing population, may compel a much more attentive consideration, than this subject has hitherto received, and one which eventually must lead to the benefit of all classes concerned.

So much for human urine. The urine of animals, as previously stated, from the nature of their food, contains much less nitrogen than that of man; but is equally, and in many cases, much more rich in the saline properties it contains, such as the phosphates of magnesia, and the salts of potash and soda. They are, therefore, by no means to be neglected, and indeed all the remarks appended to the subject of human urine apply here only with lesser force. We would, however, recommend, that all stables, farm-yards, sheds and other places where cattle are kept, should be so arranged, as for the urine to be saved, and applied in the manner we have before described.

Connected with this subject it may here be stated, that the strong volatile smell, which is almost overpowering, when entering a close confined stable, where many horses have been shut up for the night, arises entirely from the volatilizing of ammonia in the urine.

A very simple, and at the same time a very profitable way, of correcting this injurious atmosphere, is to strew the stable with gypsum, which would absorb the ammonia at once as it is formed, and prevent the presence of this gas in the atmosphere. Such an arrangement, besides being pro-

fitable, as one source of accumulating ammonia, would also act beneficially on the horses so confined, as there can be no doubt, that breathing such an atmosphere constantly for some hours together, induces a highly excited temperament, which leads to, or at all events very much increases, any local inflammatory action, and renders the cure of such a malady both difficult and uncertain.

These remarks, however, do not go to the length of suggesting the use of gypsum as a cure for such a stable, it is only a means of absorbing the obnoxious principle and turning it to account; but ventilation, to a considerable extent, is the only cure and the best.

Of the relative value of human urine, when compared with other animal matters, it is calculated by Macaire, that 100 parts of human urine are equal, in their fertilizing power, to 1300 parts of the fresh dung of the horse, or 600 of those of the cow. Nothing more therefore can be said in favor of this manure; it must now be left to those who have the means of applying and testing its real value.

In speaking of nitrogen we have fully explained how ammonia acts as the pabulum of plants, but we will here again shortly repeat it.

Ammonia is composed of nitrogen and hydrogen. Now, when the ammonia, in a state of solution, is absorbed by the spongelets of the roots, decomposition takes place, the nitrogen is assimilated to form the gluten of the seed, and the hydrogen either unites with carbon, to form the essential or fixed oil of the plant, or is evaporated through the leaves as useless matter.

That such is the effect of ammonia or nitrogen, applied under any circumstances, in which the salt is soluble, can be easily demonstrated, by applying it to any crop, when it will speedily assume a dark green color and luxuriant appearance, which is the peculiar effect of the nitrogen alone, and which is forcibly illustrated in the dark green circles, popularly called fairy rings, which exist on the downs, and which owe their dark color entirely to the mushroom or fungus spawn, existing under the surface, and which spawn consists almost wholly of nitrogen, and communicates its property to the grass growing above.

The specific action of nitrogen also, by endowing the plant with greater energy, enables it to assimilate more carbon from the atmosphere, and thus the addition of this manure, which is in every respect an essential to plants, gives it a greater power of assimilating another substance of almost equal importance as itself.

In concluding our notice of this manure we can only repeat that the liquid and solid excrement of man used together, and prepared in the way we have described, forms from its combination of ammonial salts, with the phosphates of magnesia and soda, the most valuable compound that can be devised, and its extensive use will confer a double benefit to the farmer and to the public, as well by the removal of matter, which is now only considered as a nuisanse, as by increasing the produce of the soil.

PRUNING FRUIT TREES.

From the Maine Cultivator.

Those who have fruit trees that require trimming, would do well to attend to it now. It has been clearly ascertained, I think, that the practice of pruning apple, pear, and other fruit trees at this season of the year, is much more judicious than that of pruning in the fall or winter. Perhaps there may be some whose experience would seem to point to the opposite course; and it may even be, that in certain instances, the results have been far less favorable than was anticipated.

But as a general thing, I think there can be no doubt, that wounds, caused by the excision of limbs, heal much more rapidly, and are far less detrimental to the health of the tree than those inflicted at any other time.

The *rationale* of this theory will be obvious to every one who reflects upon the subject, and need not here be explained at length. Those who have fruit trees infected with the wart, or black excrescences which have of late proved so fatal to our best fruit trees, in many sections of New England, especially the cherry and damson, would do well to look to them. There is now no ground to doubt the origin of this disease. It is caused, indubitably, by the minute perforations occasioned by vernal operations of a certain fly which seeks the soft and yielding bark as a *nidus* for their future young.

The *larvæ* of this insect being deposited in the cuticle, lies there irritating the delicate vessels, and thus occasions the exudation of the sap which originates the disease. I remember having seen an able article some years since in the Yankee Farmer upon this subject, from the Hon. Rufus M'Intire of Parsonsfield, in which it was recommended, that all limbs infected with this disease be immediately cut out. The writer represented that he had thus entirely overcome it, and that no doubt need be entertained as to its efficiency, or fears for the tree.

There are few subjects connected with the farming art on which more has been said and written, than upon this. And yet there are thousands whose trees are now suffering, and who are endeavoring to regain their regeneration by the application of remedies; the legitimate effects of which are decidedly adverse to the securement of their aim. W.

Windham, April, 1842.

The opinion of our correspondent, that this is the season of the year for general pruning, although of ancient date, is nevertheless a good deal questioned hereabouts.

Except in grafting or heading down, which ought to be done "about now," good orchardists are getting in the way, and we think judiciously, of pruning in the longest days in the year, say in June, or July.

Wounds in trees, caused either by the excision of limbs, or in the bark, heal up more readily in June or July, according to our observation, than they do, if inflicted during the flow of the sap: and the sooner this is effected after the excision, the better it must be for the tree. He who has a proper regard for the thrifty growth and life of trees, will avoid doing any thing to prevent the annual formation of the viscid substance which covers the tree beneath the bark, as this layer

is indispensable to their vigor and health. This substance is formed in the spring or early summer, by the free and regular circulation of the sap, and to trim trees before this layer is formed is thought to be very deleterious to their growth.—*Ed. Maine Cultivator.*

LIME.

From Sinclair's Husbandry.

There is perhaps no country in Europe, where calcined lime is used to so great an extent, and in such quantities, as in the more improved and improving districts of Scotland. This may be partly owing to the total absence of chalk, which abounds in so many parts of England, and which renders calcined lime less necessary there; but it is principally to be attributed to the great benefit that has been derived from its use. In bringing in new or maiden soils, the use of lime is found to be so essential, that little good could be done without it. Its first application, in particular, gives a degree of permanent fertility to the soil, which can be imparted by no other manure. Its effects, indeed, are hardly to be credited, but their correctness cannot be disputed. Maiden soils, in Lammermuir, of a tolerable quality, will, with the force of sheeps' dung, or other animal manures, produce a middling crop of oats, or rye; but the richest animal dung does not enable them to bring any other grain to maturity. Peas, barley, or wheat, will set out with every appearance of success; but when the peas are in bloom, and the other grains are putting forth the ear, they proceed no farther, and dwindle away in fruitless abortion*. The same soils, after getting a sufficient quantity of lime, will produce every species of grain, and in good seasons bring them to maturity, in all future times, always supposing the ground to be under proper culture, and the climate adapted to the crop. This fact proves, that oats and rye require less calcareous matter than what is necessary for other grains; that lime acts as an alterative, as well as an active medicine, and that the defects in the constitution of the soil are cured, even after the stimulant and fertilizing effects of the lime have long ceased to operate. Lime is also peculiarly beneficial in improving muirish soils, by making them produce good herbage, where nothing but heath and other unpalatable grasses grew formerly. The expense of this article in Aberdeenshire is stated to be enormous, very little of it being produced in that country; yet lime is there considered to be absolutely necessary, and, indeed, the foundation of all substantial improvements.† It is supposed, however, not to be so useful on the sea-shore, as in the more inland districts, from the soil being perhaps mixed with sea-shells.

The importance of lime as a manure is strikingly exemplified by the following information from Mr. Walker of Mellendean: He entered into the possession of that farm twenty-five years ago, and then gave the whole farm, (with the exception of a few acres of the *richest soil* in different fields, which had for ages been manured as infield,) a good dose of lime. From the newly-limed land, his returns were fully equal to his expectations, and greatly superior to those from the richest spots that had received no lime. Being very desirous to ascertain how long the limed land would maintain its superiority, he kept both the limed and unlimed under the same management in every respect, during his first lease of twenty-one years; and he can affirm, that at the end of that period, his crops upon the limed land were equally good, and as much superior to those of the unlimed land, as they were at the commencement thereof. Having got a new lease of that farm, he proposes laying lime upon every spot of ground that was not limed formerly, being convinced that he has been a considerable loser by his experiment. How long therefore the effects of lime may last, he will not take upon himself to foresee; but he can safely say, that there is land upon his brother's property at Wooden, that was limed by his farther upwards of thirty years ago, where the effects of the lime, upon every crop, are still as apparent as when it was first laid on the land.

It is proposed, in discussing this subject, very shortly to explain the following particulars: 1. The soils to which lime is applicable; 2. The distance from which it has been carried; 3. The quantity used; 4. The best mode of slacking; 5. The common modes of application; 6. The plan of top-dressing the surface; 7. The price; 8. The use of pounded limestone; and, 9. The causes which may occasion its failure.

1. This manure is certainly well calculated for clay lands. Some recommend laying on a certain quantity of it, to the amount of 20 bolls of shells, or 120 bushels, to the Scotch, or 96 to the English acre, and as hot as possible, every time the land is fallowed. This plan, however, is objected to from respectable authority; and it is contended, that so small a quantity of lime shells is quite unfit for stimulating any kind of soil, except where it is of a dry muirish nature, and not formerly limed. To lime land every time it is in fallow, seems unnecessary, more especially if a sufficient quantity were applied in the first instance.* From 60 to 70 barley bolls *per* Scotch acre, or from 390 to 420 bushels *per* Scotch, that is, from 288 to 356 bushels *per* English acre, are quantities frequently given in East Lothian. In regard to loams, if they are in good condition, and in good heart, perhaps liming once in the course of two rotations will be sufficient.† It is a rule, however, in regard to the application of lime, and other calcare-

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* Marl, although containing calcareous matter, is not so effective. It will produce oats, barley, and early peas in abundance, and in some situations will also produce wheat, when the season is favorable; but wheat crops cannot be depended upon from marl alone.

† Communication from Mr. Barclay, Mill of Knockleith. It is observed, that lime has sometimes been withheld both from low lands after fallow, and from hilly lands after turnips; but in all these cases, with an evident loss to the occupant, by a decrease of produce throughout the whole course.

* Mr. John Shirreff remarks, that to specify a quantity for all lands is impossible, so much depends upon the depth and quality of the soil; also on the quantity of calcareous matter, either previously applied, or originally in the soil.

† Communication from George Paterson, Esq. of Castle-Huntly.

ous manures, that they should only be applied to land in a dry state, and well drained.

2. It is astonishing the distance from which lime is carried in some parts of Scotland. Mr. Blackie of Holydean, in Roxburghshire, drives it twenty-two miles, and the carriage, when hired is 7*s*. 6*d*. *per* boll of shells. In the parish of Moffat, where of late considerable improvements have been carried on, and corn, turnips, and clover, raised in great perfection, 1000 feet above the level of the sea, the lime is carried from Douglas, at twenty-seven and thirty miles distance. It is sometimes carried on the borders, but in no great quantity, about thirty, or even thirty-two miles;* and in Aberdeenshire, it is driven that distance inland, after being imported from Sunderland.

3. The quantity used varies much. It is evident that strong deep soils require a greater quantity than those which are light and shallow. Baron Hepburn is of opinion, that it should be applied frequently, and in small quantities at a time, especially on gravelly-bottomed loams, which are apt to become too open and pliable by an over dose of lime; by following this practice, he finds his crops wonderfully improved, both in regard to quantity and quality. Mr. Robertson of Ladykirk states, that he has never seen lime used in too great a quantity, if the land is judiciously cropped; if otherwise, it will ultimately hurt the soil. He has laid on no less a quantity than 100 bolls of shells, 4 Winchester bushels each, *per* English acre, and frequently with much success. On dry fresh land a less quantity will do. Mr. Blackie of Holydean considers 16 bolls of shells, on such land, a sufficient dressing. Dr. Coventry is of opinion, that in general, about 6 tons of unslacked or newly-burnt lime, of ninety or ninety-five *per cent.* of purity, may be sufficient for the statute acre of land that has never been limed; but if the lime be impure, a greater proportion will be requisite. Several intelligent farmers are of opinion, that not less than 60 or 70 bolls of lime shells *per* acre, should be laid on a strong clay soil, and that this quantity, with judicious cropping, will be sufficient for a lease of 19 or 21 years.

The information transmitted to me by Mr. Walker of Mellendean upon this subject, is of peculiar importance, as he has limed perhaps more land than any individual in the whole island, and in the course of thirty years has tried various experiments in regard to the quantity that should be applied *per* acre. On newly broken-up land from old turf, he has laid on from 20 and 25 to 40 and 45 bolls of shells, of 4 Winchester bushels each, *per* English acre. On light and thin (outfield) soils, the crop on that part of the field that was limed at the rate of 20 and 25 bolls *per* acre, was as rough, and appeared equally good, with the crop on the land that had received 40 bolls *per* acre; but when it came to be thrashed out, the grain was found very inferior in quantity, and still more so in quality. Upon clay soils, the effects of the lime, where a small quantity was laid, were hardly discernible; while that part of the field that received 40 and 45 bolls produced an abundant crop. Finding the produce of the land that was limed with a small quantity so very inferior, he laid on, (when the land came to be re-fallowed), 20 or 25 bolls more, the effects of which were never perceptible. He is therefore decidedly of opinion, that every kind of soil should have a good dose at once, in which case he considers no repetition to be necessary for a long time after; but if repeated at all, the second liming should be considerably greater than the first, which seems to be the general opinion of the Scotch farmers. As to repeated liming in small quantities Mr. Walker is convinced, that whatever is laid out in that way, after the first dose, is so much money thrown away. He can give no stronger proof of his conviction in that respect, than his practice upon the farm of Rutherford. He entered to that farm in June 1808, and since that time he has gone over about *eight hundred and fifty acres*; and though a great part of it consists of a light dry soil, and the lime has to be carried twenty-four or twenty-five miles, consequently at a great expense, yet on no part of the farm has he laid less than 40 bolls, of shells, or 240 Winchester bushels *per* English acre, and on many places fully 50 bolls. Nothing, in his opinion, assimilates the produce of outfield, to that of infield land so much, as a good dose of lime laid on at once. The consequence of this liming has been, the most productive crops, of every description, to be seen in all that neighborhood.

Mr. Aitchison of Clements Wells also has found that lime answers every purpose he could wish, in promoting the improvement of his estate in Peebles-shire, where the climate is cold and moist. He began to improve that property in 1806, and in October 1811 he had laid on it, 10,386 bolls, or 62,316 Winchester bushels. His ridges are 18 feet broad; and according to the quantity he wishes to put on *per* acre, his overseer has the following table to conduct the operation.

If it is proposed to lay on 25 bolls *per* acre, betwixt each heap, of one firlot each, there ought to be a distance of - - - - - 30½ feet.

If 30 bolls,	- - - - -	25¼
35 do.	- - - - -	22
40 do.	- - - - -	19
45 do.	- - - - -	17

And in the same proportion as high as 50 bolls. He never puts on less than 25 bolls, or 150 bushels of shells, *per* Scotch, (130 bushels *per* English acre), and on heavy land he has gone the length of 70 bolls. The day the lime comes to the field, a man follows the carts, and covers it up immediately with earth, by which, generally in a few days, it is reduced to powder. When in that state, it is spread on the land. After trying several other methods, this was found to be the best. The improvement effected by lime on that property has been very great.

4. The slacking of lime completely is a most important operation. The common mode is, to lay it in heaps from the kiln upon the ground intended to be limed; but this, although the most expeditious, is by no means the most advantageous method. In the first place, if the lime is not all of the same quality, (which is seldom the case,) the best lime commonly dissolves first, and the inferior quality continues unslacked; so that it must either be spread in that state, or the good lime must be allowed to receive too much moisture, or again to re-absorb its fixed air, both of which should be prevented. The best mode of slacking, is to lay down the shells in a heap near to water, and by

* Communication from Mr. Walker of Mellendean.

once turning and watering the whole mass, it is reduced to a complete powder; in which state it should be applied to the soil, and ploughed in immediately with a shallow furrow, when there is no doubt but it will mix more intimately with the soil, than by the former method.* This plan, however, is attended with an additional expense of considerable magnitude.

The necessity of slacking calcined lime, as soon after it is burnt as possible, is obvious. If any sudden rain should fall, it would be converted into mortar; no art can then separate it, and mix it equally with the soil; nor would double the quantity have the same good effect. Even after it has been reduced to powder, if any rain should happen to fall, or if by any means it receive too much moisture, while it lies thin spread on the surface of the field, it will partly be formed into hard insoluble cakes, and may remain in that state for years, without mixing with or being of the least benefit to the soil. In the course of repeated ploughings, Mr. Patterson of Castle-Huntly has observed pieces of hard lime come up, as insoluble as if they had been pieces of an old building.

Considering these circumstances, I was much pleased to find, that a mode had been discovered by Mr. Niel Ballingal in Fife, which obviates these difficulties. His plan is, to lay the calcined lime down on any thick head-ridge of good earth, within the field where it is to be applied, and the instant it is so, two men are ready to make up a compost of the lime-shells and earth; three cart-loads of earth to one cart of shells, raised to a ridge long and narrow, five feet high, that rain may not enter it. The moisture in the earth slacks or reduces the lime to a powder; it swells to a considerable bulk, and then all cracks and openings are closed with a spade, and a little more earth put over the whole. In this way, he has had it frequently mixed up for six months, and in one particular instance fifteen months, before it was carted away; and yet when carried on to the land and spread, the whole mass put on the appearance of white lime, flying with the wind, as if newly from the kiln. This mode he means always to follow, being certain of its advantage. It can be mixed as intimately with the soil as if new from the kiln, and he has had crops from it, in this way, superior to an equal quantity of hot lime† both tried without dung. The application commonly is to the summer-fallow: he has also applied it to pasture, quite hot, and in compost as above described, and found both answer well: but the time of application was July, and he soon found, that it ought to lie at least one year or more before the field was ploughed.

Mr. Ballingal having used from 500 to 1000 bolls *per annum*, for several years, his experience may be confidently relied on. He remarks, that lime, if exposed to rain, or even to frost, and slacked like mortar, loses half its effect; no care can then mix it intimately with the soil. His land is wet, and often when the lime is driven unfit for carting upon the field, nor are the ridges prepared for spreading the lime; without having fallen upon such a plan, therefore, he could never have used lime to equal advantage. He adds, that an intelligent neighbor of his, brings his lime from the kiln, lays it in small heaps, about a firlot of shells in each heap, or four heaps *per* boll, on the fallow; covers these instantly with earth, which slacks the lime, and when it is completely so, he spreads it in powder, quite hot, on the fallows, and ploughs it in with a light furrow. This saves labor and expense. He never uses water in slacking lime, and the effects of his practice are very good; the earth, or rather the moisture in it, slacks the lime most completely, and no water is necessary.* This is an excellent practice, and very common in many counties: and many intelligent farmers prefer it to the other plan, which they think would be attended with too much expense to be generally imitated. At the same time, an intimate mixture with the soil is of the utmost importance in the application of lime; any plan that contributes to that object merits attention.

4. Mr. Dudgeon, of Primrose-Hill, considers it to be the most advantageous mode of applying lime, to lay it on in a powdery state, upon ground when under summer-fallow, before the fallow receives the last furrow, and then to mix it intimately with the soil, by harrowing before it is ploughed in. In regard to liming fallows, Mr. Rennie of Phantassie observes, that it is the most profitable mode of application, if it is laid on at a proper season. He has been in the practice, for these ten years past, of laying lime on his fallows, from the 1st of April to the 1st of October, and always found, that the first laid on produced the best crops, which he ascribes to its being more minutely mixed with the soil, by the more numerous ploughings and harrowings, and of course the fermentation more complete, than what is laid on late in the season: June and July, therefore, are to be preferred, so that the lime may be completely mixed with the soil before the crop is sown; and as it is both a valuable and expensive manure, too much attention cannot be given it.

Applying lime to green crops is attended with more difficulty. From observation and practice, Mr. Rennie recommends that, for a crop of turnips, lime should be laid on so early in the spring as to admit of two, if not three ploughings, and as many harrowings, after it is laid on, so as both to mix it properly with the soil, and also to let it have time to cool in the land, otherwise it will be very apt to cause the loss of the turnip crop.

Mr. Park of Windy-Mains is accustomed to lay lime on the land intended for turnips, immedi-

* Communication from Mr. Rennie of Kinblethmont.

† This is an important fact, it being generally supposed that when inserted in the form of hot lime, in a state of perfect powder, its effects are greater and more immediate than in any other way. By Mr. Ballingal's plan, the lime can be carried to the field in autumn, or even in winter, which, though an old practice, could not be done with equal safety, as under the proposed system.

* A correspondent contends that lime is best laid on the land in small heaps, and immediately covered with earth, which in a damp or moist season slacks or falls it; but he frequently puts on water from a water-cart, which slacks it directly, and it is immediately spread in that quick state, harrowed, and ploughed in, when it mixes most intimately with the soil. Lime should be in powder, and the land in a powder-like state, when it is laid on.

ately after harvest, when the land has got the first furrow. He first makes a pair of harrows go backward and forward on each ridge to smooth it, then lays down the shells in huts about 60 or 80 bolls *per* acre Scotch; as soon as it is powdered, he spreads the huts, and harrows the field, and lets it remain till May, when it may be prepared for receiving the dung.

Mr. Brodie of Garvald, who has long paid peculiar and successful attention to the management of lime, adopts the following plan in applying lime to his turnip land. After the ground intended for turnips has got a winter and a spring furrow, the lime is laid on, and well harrowed in: it then gets another furrow before making up the drills, and is again well harrowed, for the double purpose of getting the lime intimately mixed with the soil, and taking out any quickens, or other weeds, by which the field is infested. The turnips are sown in drills, both as being better for the turnip crop than when sown broadcast, and the lands are got better cleaned, either from annual or perennial weeds. It is reckoned an advantage, to have the lime got forward during the former summer, previous to its being laid on for turnips; for on a turnip farm, there is so much spring labor, that it is hardly possible to drive any considerable quantity of lime, from any distance, at that season of the year. When it is new from the kiln, it is so hot, that it is apt to dry up the moisture necessary for bringing the turnips into leaf; in this case, the lime ought to be laid on a piece of very dry ground, in large heaps, and thrown up to a considerable thickness, which will make it in a fine state for laying on in the spring, that is, neither in a wet, or in a very hot state.

In regard to green crops, Mr. Paterson of Castle-Huntly thinks it better to lay on the lime after the green crop, rather than before it, so as it may be well mixed with the soil, before it comes in contact with potatoes or other roots, it being apt to burn and blister their skins, and to spoil their appearance, if it does no more mischief. Some farmers, however, have put lime upon the ground after it is planted with potatoes, and harrowed it in. But this practice cannot be recommended.

The application of lime to grass, particularly on light or dry soils, and where the land has been long pastured, is a most advantageous system, if it is soon after to be brought into culture; otherwise, being exposed to the atmosphere, with but little admixture with the soil, it cakes and hardens, and in some measure re-assumes that unproductive quality, which it possessed, previously to its being reduced to a caustic state. It may be applied after the land has been a summer in pasture, or cut for hay; but the ground should be made as bare as possible, otherwise it will be difficult to spread it equally over the sward or surface. The lime should be laid on in autumn, and the land should remain in grass for another season, till it is absorbed. If intended to be applied to old ley, either lay the lime on one year before cropping, letting it lie upon the surface, or lay it on about Martinmas, and let it lie on the surface till February, then plough it down, and sow the ground when the weather is suitable. Suffering the ground to remain for some years in grass, is certainly the best preparation for lime, as it has then fresh mould, and vegetable matter, to act upon.

Mr. Cuthbertson recommends, that no lime should be laid on high ridges that are intended to be flattened; the ridge should be brought to the same round in which it is intended to remain, before that operation is accomplished, because, in performing it, there is a great risk of burying the lime. Mr. Barclay remarks, that when the application is made, the land should not be too wet; and it is necessary, at all times, to have the lime brought to such order, as neither to fly off with the wind, nor go into clods in the spreading.

Mr. Brodie of Garvald observes, that some speculative agriculturists recommend liming upon the surface, to extirpate the heath, and improve the pasturage, without attempting to bring ground under the plough, as the soil and climate may be unfit for the raising of grain. If the lime is at any considerable distance, there is reason to suspect that this would not turn out a profitable concern. At the distance of eight or ten miles, a good liming would not cost less than £10 or £12 the Scotch acre. It cannot be expected that this improvement, on such hills as those of Lammermuir, would even pay the interest of the money. Gentlemen proprietors may improve at this rate, but a tenant would be extremely imprudent, were he to throw away his capital, without a prospect of being repaid. It is surely better to lime land worth the improving, to bring it under the plough, and then to take a few corn crops to refund the expense. The tenant is thus reimbursed, and has an ameliorated pasture, as the reward of his industry and superior management.

Though liming the surface, "to extirpate heath, and improve pasturage," may not be a profitable concern on old swards, it is proper to observe, that when land is broken up, merely for the sake of improving the pasturage, the best, and most economical mode is, to apply lime *to the surface*, and to harrow it along with the grass seeds. A great extent of hilly pasture has thus been improved by Mr. Dawson, and others, in Roxburghshire.*

6. Mr. Kerr, the intelligent reporter of the husbandry of Berwickshire, has transmitted to me the following calculation of the expense of liming. The lime he used was brought by sea to Eyemouth; and the price, besides carriage, amounted to 2*5d. per* boll, in shells, each boll containing four Winchester bushels; hence to lime an acre of land with 35 bolls, will cost about £3, 15*s.*, besides carriage and spreading, which, the distance being short, may amount to 10*s.* more, or £3, 5*s. per* acre; and as this operation was usually repeated twice during a lease of nineteen years, liming, in his situation, may be considered as a yearly charge of 10*s. per* acre.

How astonished would not many farmers be in other counties, when they hear that Scotch farmers subject themselves to an expense of 10*s. per* acre *per annum*, for lime alone, a sum not much inferior to the average rent of land in many English counties. But the expense is well bestowed, were it only from the benefit thence to be derived in the cultivation of green crops of every description. For though such crops can be raised by large quantities of dung, yet where calcareous

* For a detailed account of this excellent method, as practised by Mr. Dawson, see the Farmers' Magazine for March, 1812.

substances are applied, as Mr. Brodie of Garvald has found by long experience, a less quantity of animal manure will answer the purpose. This is making the farm-yard dung go farther, with more powerful and more permanent effects; and from weighter crops being thus raised, the quantity of manure on a farm will be most materially augmented.

7. The use of pounded limestone, where fuel is scarce or dear, was strongly recommended by Lord Kames. He observes, that three pounds of raw lime is, by burning, reduced to two pounds of shell lime, though nothing is expelled by the fire but the air that was in the limestone, the calcareous earth remaining entire. Two pounds of shell lime, therefore, contain as much calcareous earth as three pounds of raw limestone. Shell lime of the best quality, when slacked with water, will measure out thrice the quantity; but as limestone loses none of its bulk by being burnt into shells, it follows, that three bushels of raw limestone, contain as much calcareous earth, as six bushels of powdered lime; and, consequently, if powdered lime possess not some virtue above raw limestone, three bushels of the latter, *beat small*, should equal, as a manure, six bushels of the former. These suggestions, however, have not been acted upon, probably owing to the difficulty and expense of beating the limestone sufficiently small. At the same time, the advantage derived from the use of limestone gravel in Ireland is, however, highly favorable to Lord Kames' doctrine.*

8. It is an ascertained fact, that lime is of no advantage in the neighborhood of Edinburgh, where the land has been long accustomed to aration and city manure. Mr. Allan of Craigrook, near Edinburgh, has given lime the fairest trial by liming one ridge, the whole field over, at the rate of 60 bolls *per* acre, and leaving the other unlimed, and he has uniformly found, that the liming has had no effect. The reason, probably, is this, that the land having been so often manured with Edinburgh street-dung, which frequently contains a proportion of shells, the use of stone lime is thereby superseded. Indeed, some are of opinion, that the land in the immediate vicinity of Edinburgh had been abundantly limed at some former period, which, in addition to the calcareous matter mixed with the street-dung, renders any additional liming unavailing.

Mr. Hume of East Barns finds, that lime does not answer on his farm near Dunbar, which he attributes to the great quantities of sea-ware, mixed with shells, which have been laid on these lands from time immemorial, and their having been formerly under constant crops of corn, and never in grass till lately, and even now only one year at a time. It is well known, he adds, that lime acts best on land that has been much in grass. Any local circumstances of that sort, however, cannot diminish the credit of a manure, of such essential importance to the improvement of the country.†

* It would be extremely desirable to ascertain whether limestone gravel might not be found in Scotland; to the discovery of which, I hope the attention of that public-spirited institution, the Highland Society of Scotland, will soon be directed.

† It is an interesting object of inquiry, whether lime is equally efficacious on the sea-shore, as in the inland districts? It is well known that gypsum is not.

GENERAL VIEW OF THE IMPROVED HUSBANDRY OF SCOTLAND.

From Sinclair's Husbandry.

In a communication from my respectable friend, Sir Joseph Banks, he stated, that "agriculture has derived, is deriving, and will derive, more benefit from Scotch industry and skill, than has been accumulated, since the days when Adam first wielded the spade."

I hope that the following general view of the improved system of husbandry, as established in Scotland, will justify that observation.

The foundation of improved agriculture is certainly laid, in the best cultivated districts of Scotland, in as great perfection as it possibly can be in any country. The farms are usually of a proper size;—the farmers, in general, have capitals adequate to their cultivation; they are bound to pay the landlord such a proportion of the value of the produce, as renders it necessary for them to be industrious and economical, and to acquire all the skill, in the art of husbandry, to which they can have access;—their leases are commonly of such a duration, as to encourage judicious expenditure in the improvement of their lands, with the prospect of an adequate return;—the covenants contained in their leases are sufficiently fair, being almost, in every case, well calculated to promote, and not to retard improvement; a liberal system of connexion is established between the landlord and the tenant;—and the characters of those, by whom the labors of agriculture are carried on, whether farmers, apprentices, farm-servants, or common laborers, cannot be surpassed by those of the same description of life in any other nation. The experience of Scotland has likewise proved the superior advantages of having married servants on large farms; by means of which, the population of a country is increased, and the kingdom filled with sober, healthy, and industrious subjects.*

The various points which require to be attended to, previous to the actual cultivation of an arable farm, are in general ascertained, by the practice of Scotland, with a degree of precision hitherto unexampled.

The farmers of that country have established it as a principle, that the position of a farm-house and offices ought to make a material difference in the rent of a farm;—they have ascertained the best construction of farm-houses and offices, uniting economy and convenience;—they have pointed out the best size and shape of fields, by means of which, much land is rendered productive, that would otherwise be wasted in useless fences, and much labor in their cultivation saved, insomuch that where the fields are large, five ploughs will do as much work as six can in small fields, and every other part of the cultivation of a farm will be executed with less power, in nearly the same proportion;—they have likewise pointed out the inconveniences attending expensive fences, which are more ornamental than useful to a country;—they are fully aware of the importance of draining, and have practised it with success;—they have

Sea-ware contains kelp, which, from the alkali it possesses, may act as a substitute for lime.

* These particulars are explained in the three dissertations of Part 2.

ascertained, that by the introduction of good roads, the value of a country will be greatly increased;—their instruments of husbandry are cheap, and well constructed; their ploughs excellent, worked by two horses,* and peculiarly well calculated for general use; and their carts superior to any other for agricultural purposes;—their live stock are valuable, well calculated for their soil and climate; and their horses, not only well adapted for the labors of husbandry, but maintained in such a manner, as to render them capable of performing a great deal of labor;—in some cases they have tried a partial use of oxen with success, more especially in thrashing-mills;—nor do they neglect to pay a proper degree of attention to the articles that ought to be raised upon a farm, according to its soil, its climate, its elevation and exposure, and its situation in respect of markets.

In regard to the actual cultivation of an arable farm, many points of infinite importance have been ascertained by the experience of Scotch farmers, in a manner the most satisfactory. They have ascertained the proper length, breadth, and shape of ridges;—in the use of putrescent, and still more of calcareous manures, they have made great improvements; they have proved, beyond the possibility of doubt, the advantages of deep ploughing;—they have completely ascertained the advantages of summer-fallowing, where soils are either of a clayey nature, or are incumbent on wet subsoils;—they have carried on with success, some essential improvements in the cultivation of various crops, in particular in regard to those important articles, turnips and potatoes;—they have also brought to a high degree of perfection the course of crops calculated for different soils; and have ascertained the rotations for which each description of soil is respectively best adapted;—they cultivate in drills, beans, turnips, and potatoes, in a manner not to be surpassed for its excellence, and they have laid it down as a maxim, that crops of grain should be drilled, where the land is sown in spring, particularly where it is subjected to annual weeds;†—they have also made some improvements in harvesting grain; in particular, the plans of cast-iron pillars and bosses, are admirable inventions for a wet climate, by means of which, the harvesting of grain, and of pulse in particular, may be completed in half the usual time;—they have brought the cleaning and thrashing of grain to the highest degree of perfection; almost every individual, who has any claim to the character of a farmer, having fanners in his possession, and thrashing-mills having become almost equally general;—they have carried, to a great extent, the practice of soiling horses, and even cattle; and have proved, by decisive experiments, the superiority of that plan;—they have restricted the practice of preserving permanent pastures within reasonable bounds, and have proved, that the convertible system of husbandry, may be generally adopted, to the great benefit of the landed proprietor, and of the public.

These are circumstances connected with the improved system of husbandry established in Scotland, the existence of which, I trust, is abundantly proved in the course of the preceding observations.

The result of this system is in the highest degree satisfactory. In all the corn districts, where the convertible husbandry is thoroughly established, greater crops are raised, and higher rents are paid,* than in any other part of the British dominions, and, what is equally remarkable, the condition or circumstances of those engaged in agriculture evidently bear the like marks of abundance. Without enlarging upon these matters in this place, I may only add, that the produce of crops, in good seasons, and in fertile districts, is calculated to be from 32 to 45 bushels of wheat, from 48 to 55 bushels of barley, from 60 to 75 bushels of oats, and from 30 to 35 bushels of beans, Winchester measure, *per* statute acre. As to green crops, 30 tons of turnips, 3 tons of clover, and 8 tons of potatoes, *per* statute acre, are no uncommon crops. Any system that can produce crops of so superior a description, even on fertile soils, is well entitled to imitation, more especially when it is accompanied with great economy in the expense of cultivation.

Forty-four years have now elapsed, since one of the ablest writers on agriculture in modern times, (Lord Kames,) pointed out the imperfection of Scotch husbandry; and it is singular that, with hardly any exception, these imperfections have since been removed. Had it not come from such high authority, it is hardly possible to credit, that within the memory of so many persons now living, our agriculture could have been so miserably deficient as it seems to have been at that time. The learned Judge represents our instruments of husbandry as sadly imperfect;—our draft-horses as miserable creatures, without strength or mettle;—our oxen scarcely able to support their own weight, and ten going in a plough, led on by two horses;—the execrable husbandry of infield and outfield generally established;—the ridges high and broad, in fact enormous masses of accumulated earth, that would not admit of cross-ploughing, or of proper cultivation;—shallow ploughing universal;—ribbing, by which half the land was left untilled, a general practice;—summer fallow, though common in three or four counties, yet only creeping on in others;—over the greater part of Scotland, a continual struggle for superiority between corn and weeds:—the roller almost unknown;—no harrowing before sowing, and the seed thrown into rough uneven ground, where the half of it was buried;—imperfect rotations of crops;—little skill in harvesting;—no branch of husbandry less understood than manure;—potatoes in general propagated in lazy-

* In Norfolk they use only two horses in a plough, but four horses are commonly allowed for each plough, two for a journey of five hours in the morning, and two more for another journey of five hours in the evening.

† It must be admitted, at the same time, that the drilling grain crops, is more generally practised in England, than in Scotland, but that is not the case in regard to beans, turnips, and potatoes.

* Mr. Curwen, in his Report to the Workington Society for the year 1810, p. 86, states the rent of fertile land in East Lothian to be, £6 *per* Scotch acre, and the produce, 40 bushels of wheat, 60 of barley, 90 of oats, excellent beans, weighty crops of turnips, and most luxuriant crops of clover. It is proper, however, to observe, that this is only applicable to the more fertile soils. A farm of 330 acres of arable land near Dunbar has lately been let at £8, 2s. *per* Scotch, or £6, 10s. *per* English acre.

beds;—swine but little attended to;—and very few farms in Scotland justly proportioned to the skill and ability of the tenant.* What a contrast to the description I have just given, of the husbandry of Scotland at the present period!

Among the circumstances which have occasioned so extraordinary, and so rapid a change, in the husbandry of Scotland, that turn for reading, by which the Scotch farmers are so peculiarly distinguished, though already pointed out, ought to be more fully dwelt on. Nothing can be more absurd than to imagine, that the communication of information by printing, which has promoted the advancement of every other art, should be of no use in agriculture. It is not recommended, that a practical farmer, should take for gospel what he reads in print, and should alter his whole system accordingly; but let him reflect on what he reads, let him try, on a small scale, useful experiments, and let him extend them when they are found to answer. At any rate, he may find in books a number of useful hints, which may be entitled to further inquiry. Hence the writings of Kames, and those of Anderson, Dickson, Home, Wight, &c. in Scotland, and those of Arthur Young, Marshall, and others, in England, gave a great spur to the improvement of Scottish husbandry, by directing the attention of the farmer to the principles of that art to which their lives were devoted.

The practice adopted by the Scotch farmers, of travelling to England, and in some cases even to foreign countries, removed a cloud of prejudices, which could only be speedily, and completely eradicated by ocular inspection.

No circumstance, however, had a more powerful influence in promoting a spirit of improvement in the northern part of the kingdom, than the formation of a Board of Agriculture; and from that era, in the opinion of the best informed agriculturists in Scotland, may be dated that wonderful change which has taken place in Scottish husbandry. In consequence of that establishment, as remarked by an intelligent farmer,* "a general desire seized all ranks to promote internal improvement. By means of that institution, great numbers of new men were brought forward to public notice, whose names otherwise would probably never have been heard of; and these being chiefly practical people, in other words, persons professionally concerned in farm management, agriculture, by their endeavors, was rescued from the hands of theorists, and a revolution of no small extent accomplished in rural affairs. Before the Board was instituted, the bond of connexion amongst agriculturists was slender, and served few useful purposes, each standing on his own strength and information, and unless in the case of those who travelled about to collect useful information, (and the number of those, at that time, was not great,) they new little more about the practices of conterminous districts, than those of China, or the most distant countries. The establishment of the Board did away at once all those evils and difficulties: a common fortress, erected for the benefit of all agriculturists, and to which each might resort for advice and protection, was immediately recognized. It made farmers, who resided in the most distant quarters of the kingdom, acquainted with one another, and caused a rapid dissemination of knowledge amongst the whole profession. It did more—the art of agriculture was brought into fashion; and this being the case, old practices were amended, new ones introduced, and a degree of exertion manifested, which had never before been exemplified in this island. The numerous surveys of husbandry, executed under the authority of the Board, were of singular advantage also, because they brought to light the practices of every country; and whilst they pointed out the obstacles which lay in the way of improvement, stated the most effectual methods of removing them. The very collision of argument, which such discussion occasioned, was of advantage, causing agriculturists to investigate the principles of the art which they professed, and inducing them to search after new channels of improvement. In a word, the Board, in a few years, collected a mass of agricultural information, hardly to be equalled, and not to be exceeded, by the accumulated stores of every other nation."

Mr. John Shirreff likewise attributes the rapid improvement of Scotland, to the interesting information communicated by the Board of Agriculture, at a time when the minds of men were qualified, from education and observation, to put a proper value on it, and whilst their capitals, arising from that powerful stimulus to improvement, leases, enabled them to execute those improvements which this interesting and various information suggested.

In a communication from Mr. Charles Alexander, a respectable farmer near Peebles, it is observed, that the publications of that Board, and other recent works on farming, in particular "The Farmer's Magazine," printed for the express purpose of promoting the views of the Board, were read with avidity; that a spirit of inquiry was thus excited, and that improved agriculture was universally considered to be *a sort of coining of money*. Hence a large share of capital, that did not originally belong to agriculture, and never was acquired by it, was thrown into the scale; an unprecedented competition arose for purchasing and leasing land; an increased spirit of agricultural improvement was the result, the effects of which soon became almost universally conspicuous.

The exertions of many other public-spirited institutions, in particular those of the Highland Society of Scotland, were of the greatest service; and a number of provincial societies, in their several districts, propagated the spirit with success.*

But information and skill would have been accumulated in vain, had it not been that, by the extension of paper currency, and the establishment of banks and branches in almost every county in Scotland, the farmers were furnished with credit, and supplied with the readiest means, of converting the produce of their farms into the circulating medium of the country, and were

* See Kames's Gentleman Farmer, Appendix, Art. I, On the Imperfection of Scotch Husbandry.

† See Brown of Markle's Treatise on Rural Affairs, vol. 1, p. 20.

* The advantages of provincial societies are ably explained, by Sir George S. Mackenzie, in the Rossshire Report, p. 332.

thence enabled, not only to continue their exertions, but to lay out considerable additional sums on the improvement of their several occupations.

These circumstances combined, in addition to those already pointed out, will, I trust, account, in a satisfactory manner, for the great advancement that has been made in Scottish husbandry.

THE FARM AND FARMING OF THE REV. J. H. TURNER.—NO. IV.

For the Farmers' Register.

In my last, No. 3, I promised to take up the hacknied subject of rotation. But my pony (Monsieur Tonson again) stands at the door already caparisoned, and by her wistful looks, invites me to another excursion. I now have a strong bit on the frolicsome jade, and I intend to hold a tight rein, so that I think there is but little danger of her again running away with me.

I wish to say a little more about that harassing thing called *debt*. "A burnt child dreads the fire;" and I have been so hampered and harassed, and have suffered so much on this score, that I would warn all farmers against it, as one of the sorest and most inconvenient troubles that can come upon them. If any are already involved in this dreadful vortex, all I can say is, that they must get out—*as they can*. Nothing is easier than to avoid debt, when fairly out of it. Here, as in many other cases, one ounce of *prevention* is worth whole pounds of *cure*. It is simply to make the matter turn on these two questions: Do I really *need* the thing desired? And am I in circumstances to pay for it? If these two questions can be answered in the affirmative, then it is safe to buy. On any other principle it is always unsafe, and therefore all idea of purchase ought to be banished from the mind.

But it is really a little singular how very insidious this thing often is. The article wanted is a *little* one, and its cost a *mere trifle;* or the circumstances are so peculiar, as to constitute an emergency. The old carriage has become quite shabby, and wife insists upon it that a new one is indispensable; or Miss appeared at church with a new frock made up in the new fashion, and this attracted more attention from all the *young* people than the sermon did; and for this very *solid* reason, all the misses, whether their fathers can pay for them or not, must have a new fashionable dress also. It is also astonishing how important a bearing that word *decency* is made to have upon expenses of this sort. I *once* had a very exalted opinion of that word. I still think it a very comely one. But when I see that it is made the occasion of throwing aside the old carriage, or the old coat, though still comfortable, and of going in debt for new ones, I candidly confess that my attachment for the word is considerably weakened. The practice, with all its *decency*, is, to say the least, a very inconvenient one.

The propensity to buy things, not because they are *needed*, but because they are *cheap*, cannot be too strongly reprehended. The *men* are commonly keen enough at making a bargain; but the fair sex will excuse me when I say that, in this respect, they certainly take the palm from us. If a *good* bargain is offered, they cannot resist the temptation of making it their own. Good, prudent souls, like the industrious ant, they must be storing away for future wants. Some time ago, the following characteristic incident took place when I happened to be present. Madam had just returned from town, whither she had gone to purchase some necessaries for the family. After producing these, in which she seemed to take no particular interest, she proceeded to display, with great delight, the rich stores of *bargains* she had made. "See," said she to her good man, "here is a new shawl for Julia, and a new bonnet for Emily, and a new frock for little Sarah, all in the newest fashion. Now don't you think them very beautiful?" "Yes, my dear, I think they are; but," continued the good man, "I thought our daughters were already supplied." "They are," replied the lady; "but these were *so very cheap*. Why what do you think I gave for the whole?" "I can't tell, my dear," was the loving reply; "but one thing I know—that if you continue to buy things at this rate, because they are *cheap*, I shall soon be unable to procure *necessaries* for my family."

Our merchants, too, are often to blame in this matter. A customer enters the store. Both partners of the concern and all the clerks directly put on all the airs of their politeness. "Will you allow me to wait on you, madam? What will you have, madam?" And, without waiting for a reply, the shelves are immediately stripped of their contents, and the counter loaded with goods. "Pray, sir, don't give yourself so much trouble." "No trouble, madam; it gives me great *pleasure* to wait on you. See this beautiful goods—and cheap! I never had such cheap goods before. I bought it the other day at auction; and I can sell you the greatest bargain in town." Thus the voluble merchant runs on praising his goods, as the prettiest, the best, and the cheapest, until madam is induced to buy, perhaps beyond her ability to pay. The merchant will accommodate her as to credit also, and then raise a great clamor, that the *country people* will not pay their debts.

These were my cogitations during my excursion, and I hope the reader, ladies and all, will excuse me for presenting them just as they occurred. I now retire to the writing desk, and rotation in crops is the next topic that I am to treat of.

This, at various times, and in various forms, has been the fruitful source of discussion among our best and most influential farmers. Perhaps there is no subject, in the whole routine of farm management, on which more thought and ink has been expended. And even now, the contending parties seem as far from entire agreement as they were several years ago. Almost every farmer, especially those who go into the business on a large scale, seems to think that some rotation is necessary; but it is a rare thing to meet with two whose theory and practice precisely agree in this matter. The old rotation used to be corn and wheat, and then corn and wheat again. But finding that on this plan there was a constant falling off in the crop, until the land would produce neither the one nor the other, a *third* year was added, in which the land was allowed to rest. The rotation then was, corn, wheat, rest. To this was afterwards added a *fourth* year; and then the case stood thus: the first year a little corn, the second still less wheat, the third rest, as far as the

ravages of the famished cattle would let it have rest, and the fourth year a crop of briers, sassafras, persimmon, &c. So things continued, our agricultural prospects becoming more and more gloomy; our population starved out at home, and forced to the west in quest of land on which they could live, until some one conceived the idea of interspersing a grass crop, which has proved itself to be the great renovator of worn out lands. The rotations are now a vast deal more judicious than formerly. Indeed, I know of no rotation now, in which grass is not made to hold a conspicuous rank, and to this some have added peas and oats, to be turned in, in a green state. But still this subject continues to be a very vexed one, no general agreement having as yet been fixed on, as to how these several crops ought to succeed one another.

Hitherto I have maintained an entire silence on this question; and it has been a source of considerable amusement to me to watch the progress of that good natured and genteel controversy, in which some of our most worthy and substantial farmers are still engaged. And I think it more than probable that it would be good policy in me still to maintain the same attitude. But as I shall make an attack upon no person, nor upon the favorite system of any one, but simply express my own sentiments, I hope my fellow farmers will take them for what they are worth; and I hereby bespeak their kindness, that if they think proper to inflict upon me a castigation, it may be as moderate and gentle as possible.

And now, that I may enter on the subject at once, I would inquire, what is the great object of all farming, rotation among the rest? It is (if I mistake not) to derive as large a product as possible from our lands, and at the same time to leave them in a condition to produce as large or even a greater amount in the succeeding crop. If the crop remain uniform and stationary, there is evidence that the fertility of the land is the same; but if there be an increase or falling off of the crops, there is evidence of the increasing or decreasing fertility of the land. The power of production is therefore the great criterion by which we are to test the true condition of our lands.

Now the great desideratum in farming is to make the lands highly productive, and at the same time maintain them in a state of continual improvement. He who has arrived at this point, has reached, as I think, the "Ultima Thule" of good and skilful management. But the great matter is, by what rotation, or other expedient, is this to be effected? To this I reply, that this whole vexed question, on which there is almost as great a variety of opinions as there are different farmers to entertain them, is with me reduced to the limits of a mere "nut-shell." My theory is, that all crops whatever, whether corn, wheat, clover, or what not, especially if permitted to mature themselves, and then removed from the land, are, from their very nature, *exhausting*. This being conceded, the matter is made very plain. If the land undergoing cultivation is already rich, and we merely wish to maintain it in its present condition, all we have to do is to return to it an amount equivalent to that removed. Or if the object be to increase fertility, then the plan is to give it *more* than is taken away. And in adjusting this account, the land, if I may be allowed the expression, is rigidly and scrupulously exact. It will tolerate no cheating nor imposition whatever. If more be taken than a just proportion, the barn or corn crib will be filled, but it will be with a corresponding injury to the land. Whereas, if we proceed on a liberal principle, the land will not be outdone in generosity, but will open her kind bosom and pour forth a bountiful supply. It is, therefore, in vain, as I think, to talk of one crop as an enricher, and of another as an exhauster. They are *all*, grain, grass and every thing, exhausters; and they are exhausters in proportion to their own amount. If the crop be a heavy one, the exhaustion is heavy, but if it be a light one, the exhaustion is proportionably light. Now I do not wish it to be understood, that I consider all crops *equally* exhausting. Some for instance have broad leaves, for the express purpose, as I suppose, of deriving a large portion of their sustenance from the atmosphere. Now just in proportion as support is derived from this source, a less amount is needed from the land, and therefore less injury is done to the land in producing its crop. But the sentiment I wish to inculcate is, simply, that the injury done by one crop can never, by any rotation whatever, be repaired by another. On the other hand, this second crop, when removed, does but increase the injury done by the first.

But it will be inquired, do you advise a succession of the same crop on the same land, without regard to variation of any kind? To this I reply, that I see no objection to it, *provided* there is fertility enough in the land to sustain it; or in default of this, that the deficiency be supplied from some foreign source. The general theory on this subject, if I understand it, is the following: that the land contains certain ingredients; that some of these ingredients are suited to one crop, whilst others are adapted to other crops; and that these several crops, during their growth, appropriate to themselves only what is proper for them, leaving the residue to others which are to follow. Now, if this theory be true, then it follows that rotation is not only *necessary*, but that cropping cannot be carried on without it. This whole theory turns upon this one point: Are there in fact peculiar ingredients in the soil, suited to a particular crop; and may these be so taken up by that crop, as to render the soil unfit to reproduce the same? To this I reply, that there is one ingredient which, when exhausted, is destructive not only to *that* crop, but to all other crops, and that ingredient is *fertility;* and my theory is that this ingredient is just as necessary to one crop as another. I will, therefore, with the risk of a severe castigation from some brother farmers, frankly acknowledge, that I have no great faith in any rotation, from which regular supplies of manure of some kind are excluded. I will even go further, and say that, in my view, it makes but little difference what the succession of crops may be, provided there be a constant supply of enriching materials equal in amount to the crop which is removed.

And now, as I confidently expect to be attacked for this very heterodox sentiment, I will take the liberty of making my defence in advance. And here I would remark, that what I call fertility, a term understood by every body, is expressed by different writers by different names. Professor

Webster (I think it is) calls it *humus*, and Professor Dana calls it *geine*, and Liebig calls it *ammonia*. Now, without resorting to long quotations, which would merely cumber this piece and add nothing to the argument, I will simply state that these three learned gentlemen do agree that the above are the only ingredient necessary to the thrift of a plant; and that where they exist in proper proportions in any soil, that soil is a fertile one. Dr. Dana expressly says, (Second Report of the Agriculture of Massachusetts, page 165,) "if we can induce the state of geine best fitted for each plant, then adieu to the doctrine of the necessity of a rotation of crops." But in a plain discussion, such as this is intended to be, I would rather rely upon common sense, supported by observation, than upon any authority of the learned whatever. What are the *facts* then in the case? The Rev. Mr. Colman, commissioner of the above report, states it as a fact, that he saw a rich alluvion field on the Connecticut river, the proprietor of which told him that, without any manure, it had continued to produce good crops of wheat for *thirty* years in succession. In corroboration of this, I well recollect that, when I was a boy, my mother had her cotton patch, which continued to produce the same crop year after year, for I know not how long a time. There was also on the same farm a sweet potato patch which shared precisely the same fate. In addition to this, it is within my knowledge, and can be proved by hundreds of others, that the late Dr. Tazewell continued to cultivate corn on one of his lots near my farm, for more than ten years in succession; and that his last crop was inferior to his first, only in consequence of the exhaustion of the land. Here then is wheat, and cotton, and sweet potatoes, and corn, not one of which is dependent on a *rotation* of crop for their success.

But there is another department, in which cropping is going on, on a much larger scale, in which, as I think, I am borne out in the above position. This great department is the world, and the crops are the immense forests with which it is covered. Now here is a great crop produced, and according to my position, it must be at the expense of an immense exhaustion. Here too is no relief arising from rotation, for the same crop has been on the land for thousands of years. And yet this same good farmer, Nature, has so contrived, that without the least rotation in all that time, the fertility of all that land of which she has had the exclusive management, has not only been maintained, but has constantly improved. Nature's farm presents at this time a most singular anomaly of bearing an increasingly heavy crop for thousands of years in succession, and is at this day in better heart, than it was when she took it in hand. It is simply because nature's wants are all *real*, and therefore *few*. Her main object has been, what ought to be the main object of every farmer, to keep up the fertility of her land. And how has she accomplished it? Not by a rotation, but simply by returning the crop to the land which produced it.

But whilst nature has constantly set this wise and laudable example, man has come in, and though endowed with intellect, and calling himself the "lord of creation," has made a very poor affair of *his* farming. He has taken his little patches, and under the growings of his artificial wants, has taxed them to the full amount of their ability, and appropriating the whole products to himself, and giving back nothing to the lands, has reduced both them and himself to a state of beggarly starvation. And now he is trying to repair the injury, by a rotation of crops. This, as I think, is only calculated to make matters worse. When I see land refuse to bring one crop, I consider this as plain evidence that it will refuse to bring another. The rotationist however is of a different opinion. He tries corn, and fails, he then tries wheat, and fails also, his next effort is with clover. here is another failure, his last resort is to black-eyed peas, these may be *sprouted*, but there will be a failure in this crop also.

Now what can be the cause of all these successive failures? Some *special* ingredient is wanting is the soil. Yes! this is the truth. And what is it? Learned men call it humus, or geine, or ammonia; but I call it by the vulgar name of *manure*. Put manure on the land, and it will bring corn, and wheat, and clover, and peas, and any thing else, and that without regard to any particular rotation. The very best rotation, then, (and gentlemen will surely thank me for solving this difficult problem for them,) is that which brings the most frequent and plentiful supplies of manure on the land. With this medicine, administered not in broken doses, as timid physicians recommend their nostrums, but the whole portion swallowed down at once, I have never known any rotation to fail. Grain crops may follow grain crops, and grass crops may follow grass crops, or *vice versa*, and all will find in the soil the very *special* ingredient that they require.

But it was stated above that, in my opinion, some crops exhaust more than others. By this I mean that some have a more pernicious and injurious effect on the land than others. I have no doubt that grain crops are more injurious than grass crops. And why so? It is not because the grass does not, in common with the grain, take up the nutriment of the soil, and thus impoverish it. The fact is, both are exhausters, whether to the same amount, I pretend not to determine. One thing, however, is certain, that land will continue to produce grass longer than grain: and the reason is a very obvious one; for as soon as you remove the grass, it makes an effort to recruit itself, and I have known it to succeed in doing so, to the amount of the first crop. The second crop then falling and decaying on the land contributes materially to the fertility of the soil, and in this way we may account for the fertilizing effects of the grass. The grain crop, however, being wholly removed, and making no effort to recover itself, must necessarily be a rapid exhauster.

But it will be objected, that by following nature's model, as so much lauded above, we shall defeat one great object of all cultivation, which is to supply our numerous wants. Nature, it will be said, has but one want, and her whole crops go to the supply of that one; whilst man has numerous wants, and therefore cannot be equally generous. To this I reply, that the farmer's *greatest* want is rich, productive land. His first care ought therefore to be to supply this want; and if he can but succeed in this, he will find no great difficulty in supplying all other reasonable wants. Fertile lands will fill his corn-crib, and plenty of corn will

not only make his hogs merry, but will diffuse an air of cheerfulness over the whole establishment. But here is the rub. After nature's law has been violated, and by frequent removals of the whole products, positive impoverishment has ensued, how is the land to be resuscitated? To this I reply again, that here is a case that is plainly beyond the reach of any rotation in cropping. It is, however, a matter of comfort, that land labors under but one single disease, and that is poverty. It is, however, highly infectious; for it is almost sure to communicate itself to the proprietor, and then it spreads through the whole family; and when the land, proprietor, and family are all down together, the case is really a bad one. But even in this event, discouraging as it may seem, there is a remedy. Swaim, with his panacea, and Brandreth, with his pills, have each pretended that he has discovered a remedy for all the "maladies that human nature is heir to." Now I pretend to no quackery in human diseases, but I do think I have found a specific for the only disease that afflicts the land; and this specific is not rotation, but enriching manures of some kind. How these manures are to be obtained, I shall not now, of course, attempt to explain. Every one acquainted with the circumstances with which he is surrounded, must judge of this matter for himself. I will, however, just remark, that whilst a deficiency exists in one point, there is commonly a superabundance at another; and that it requires but little skill so to concentrate one's resources as to make them most available.

After the above statement, the reader will not be surprised when I inform him that in my practice I rely but very little on any system of rotation whatever. In fact I rely scarcely any on this source, to keep up the fertility of my lands, much less to increase it. My main crop for market is hay, and every thing is conducted on my little farm to make this crop as large in amount, and as good in quality, as I can. The fields are, therefore, continued in grass as long as they will produce a fair crop. When the fields become so infested with greensward and other filth as materially to lessen the crop—which is uniformly the case on all the high lands in three years, and sometimes in two—they are then ploughed up, and a corn crop is resorted to, to cleanse them. Some time ago, when my lands were less fertile, one crop of corn was sufficient for this purpose. It now requires two, and these in immediate succession. My system of alternation therefore is, two crops of corn, one of oats, and three of grass; and this I adopt not with the view of improving or even keeping up the fertility of the lands, but simply because I consider it as the best course in reference to my main crop.

The reader will not also be surprised when I tell him, that I never tolerate any grazing in any field, or at any season of the year. I have seen the idea advanced, and that too by thrifty farmers, that grazing was beneficial to the lands. I will believe this when I am convinced that the right way to keep up strength is to take away all the sustenance by which it is maintained. No one pretends that the removal of a crop adds any thing to the fertility of land. But what is the difference whether it be removed by the cart, or by the capacious stomachs of cattle? But it will be said, that in the latter instance it is again dropped on the land. True, but these droppings are so dispersed, and at intervals so wide apart, that every one must see that they do but very little good. There is one event, and but one, in which I would approve of grazing, and that is where the farm is a large one, the grass abundant, and the market too remote to carry the crop there in any other way. But in this case, the animals should be penned every night, and thus the manure concentred and made available. But it will be said that the *hoof* is necessary to the solidity and compactness especially of light lands, to make them produce wheat. But I should think that the same, or even a greater amount of compactness, might be secured by a heavy roller, and thus save the fields from the severe scourge of the animal's tooth. A fall fallow, late in the season, will ordinarily secure the succeeding crop of corn from the depredations of worms. But my paper is again too long. I therefore merely throw out these few hints for the present. At some future time I may resume the subject. The probability is that I may prepare one or two more numbers, but at present I cannot say on what subjects. The fact is, the season of the year has now arrived when farmers ought to go to work, and I am much more ambitious for the fame of a *working* than of a *writing* farmer. J. H. TURNER.

CHOICE OF LANDS.

From the South Western Farmer.

Many are every day emigrating to our state, and we hope before long to see the tide increased. Many too of our present settlers are every year adding to their clearings—and spreading cultivation farther into the ancient woods. For the benefit of such we propose to give a series of articles on the choice of lands, and the marks by which good and inferior lands may be distinguished in our climate. We have been to a considerable extent over the country, and have had some experience in this matter, but we know there are many better acquainted than we are with the subject; and the chief good we hope our articles to accomplish is, to excite the attention and aid of such individuals to the matter.

The most certain and simple manner of judging of the qualities of lands is by the peculiar growth. With prairies, where this mode of course could not be practised, we have little acquaintance, and we know no certain rule for ascertaining the qualities of such lands except analysis. We will before long get the apparatus necessary for this, when we will endeavor to give more particular information on every branch of the subject. But upon timbered land every farmer knows that the liability to overflow in swamps—the adaptation to cultivation—the richness of the soil—and its fitness to carry particular crops,—may all be ascertained by inspecting the peculiar growth the land in a state of nature produces.

We will take the varieties of trees, &c. in alphabetical order, and to give more utility to our articles we will add remarks on the qualities of the particular kinds of timber.

Apple, wild crab.—Though occasionally found growing on dry spots, it generally denotes a cold, tenacious, poor soil, and one which will be too

wet in the spring for cultivation. It is most common on the borders of low wet prairies.

Ash.—A plentiful, large growth denotes very superior land. It is never found with us on poor land; and except on the best it is scattering and small. In swamps the ash, with the butt growing up for some distance much larger than the trunk higher up, and the inequality ending abruptly, is a certain mark of frequent overflow. The ash denotes good corn land, and we would suppose equally a mark of land adapted to small grain.

In this country we are without the white or swamp ash found at the north, and so much used in carriage making, &c. Our ash is not tough and hard like that, but has an open grain, and is among the most *brash* or *breakly* of our timbers. It is very dry and makes better fire wood when green than any other tree we have. Its ashes have also been found among the most valuable for lie. The ash lasts well exposed to the air, but soon rots when buried. In common with all the trees which have a large portion of their trunks sap, the ash can seldom be deadened so as to die the first year.

Beech denotes good second rate land with us, and is never found except on loose mellow soil, which may never produce the best, but is very reliable for certain crops.—It is sometimes found in swamps which overflow, but in none which do so often and to any depth. Beech, like the ash, lasts well in the air, but soon rots when buried. The tree is easily deadened by taking out a thin chip in circling it.

Box elder.—This is one of the semi-dwarfish trees, and grows only on rich ground. To find it spontaneously attaining any size, therefore, is a certain mark of a good soil. It will grow in overflowed land, however. Of the qualities of the timber we know little. Its bark and leaves are said to possess valuable medicinal qualities.

Cotton wood.—This is a tree which never attains its growth except on the richest soils, and is never found naturally on any other. Though generally found in swamps, it will occasionally be seen on uplands which are rich enough. It will grow on overflowed soil. The timber is light and porous, and of little value, though it makes tolerable fence rails, and when dry pretty good fire wood. It rots almost immediately in the ground. It is not easily deadened, except by firing at the roots, the first year.

Cherry.—The wild cherry common among us, never attains a size over a foot or two through, except on the best soil. It denotes too freedom from overflow when found in bottoms. It is easily deadened, and the wood is extremely lasting and valuable in any use.

Cypress is an unerring mark of low, overflowed swamp land. When cypress land is reclaimed, however, it is found to be mellow and productive, and the tree is easily deadened. Though soft and porous, cypress is a most valuable timber, splitting out easily into shingles, &c.—easily sawed into lumber—and either in the ground or in the air extremely lasting.

Cane.—To see the large high cane we once had so plentiful among us—attaining the height of 25 or 30 feet—is a certain mark of the best kind of soil. On poorer soils it will never attain its full growth. Overflows kill it. So that in swamps subject to overflow, it is seldom found at its full size. It takes some six or seven years for it to grow to full size, and unless the land has been exempt from overflow for that length of time, large cane will not be seen. It goes to seed at long intervals and then dies spontaneously. It is a variety of the same species as the bamboo. In another article we will give a history of its seeding and growth.

Dog-wood.—This is another tree of semi-dwarfish growth. It is never seen on the very poorest land. But from that which is thin to the richest it is found flourishing in all. To find it growing in swamps however denotes exemption from overflow. The tree is too small to make the timber worth notice.

Elm.—This tree will not grow over a foot or a foot and a half through, except on rich land. It will not grow on lands much subject to overflow. It is easily deadened. And the heart of the tree is extremely tough and lasting, both in or out of the ground. It is used by our wagon makers for the hubs of their wheels. Also, for the screws to our cotton presses. The bark of the slippery elm is well known to have valuable medicinal qualities. The wood however is not so tough as that of the red variety.

Gum.—The black gum grows indiscriminatingly, on thin and rich lands. Its superior size on rich lands however is a distinguishing mark. It is not easily deadened the first year; and the timber is of little value—being too tough to split and shrinking and cracking very much in seasoning. The sweet gum, of the size of 4 feet and over through, is a very common tree in our rich bottoms, and on poor land is seldom seen except of a small size. It is a difficult tree to deaden; and the timber is nearly worthless. It rapidly rots in any situation.

Hickory, of a small size, growing thickly or predominating, denotes a good soil, though shallow. Large sized trees are found occasionally on rich and deep lands. The common kinds are seldom found in overflowed lands—but a variety with rough scaly bark found in swamps is a certain mark of inundation. The timber is too well known to need description. It is not lasting, and soon rots in the ground. The hickory to be deadened the first year must be chopped round entirely through the sap; unless this is done it will continue vigorous to the second summer.

Holly.—This tree is a certain mark of good land. It is semi-dwarfish—difficult to be deadened—and loves swamps which are not much overflowed. The timber is very white and close, and is used by cabinet makers for inlaying.

Haw—black.—This shrub denotes rather a thin soil, never being found on our richest. It grows only in dry spots. Of the *red* there are two kinds, one with many thorns and a fruit much larger than the other—nearly the size and shape of the crab apple. This kind grows only on high dry spots, denoting a poor soil. The other has the fruit of a smaller size in clusters, and sweeter tasted, and the tree grows taller and is freer of thorns. This kind loves swamps and low places, and generally denotes a rich soil though wet and tenacious.

Hornbeam, or iron wood.—This is another semi-dwarf, and denotes, like the beech, good second rate land—never being found on either the richest or the poorest.

REJOINDER UPON THE SUBJECT OF MANURES, &c.

To the Editor of the Farmers' Register.

Sandy Point, May 15, 1842.

Please to afford me a small space on your pages to reply to the remarks of the Rev. Mr. Turner, on my strictures on his anonymous essay on manures, &c., which appeared in your January number. From the general tenor and train of ridicule in his remarks, he doubtless intended that they should act as an extinguisher, and sweep all such ephemera from his path in future, even when he chooses to write anonymously. I have not failed, Mr. Editor, to appreciate the agricultural writings of Mr. Turner, and to pay to his known and subscribed opinions a respectful deference.

In his remarks on my strictures relative to his mode of managing stable manures, he says, "By what management can manure be most rapidly increased? Is it by daily throwing it out in small quantities, &c.?" In reply to which I here repeat, as the result of my own experience, and that of the majority of the most intelligent and experienced farmers and horse owners, that, from a due and prudent regard to the comfort and health of the horse, manure ought *never* to be allowed to accumulate in the stable beyond 24 hours, and if oftener cleaned out the better; and I do assert that, by cleaning out the stable daily, a greater amount of manure, and that of a better quality, can be made, than by allowing it to accumulate in the stable. Were I asked "what would be the surest mode of obtaining *fire-fanged* manure?" I would unhesitatingly reply, "allow it to accumulate in the stable;" and foul stables are well known to excite and aggravate many of the diseases to which the horse in his domestic state is liable. It is rather a singular doctrine for the reverend gentleman to advocate and recommend—the permitting of a *known* evil, that (doubtful) good may result. "An ounce of prevention is worth a pound of cure."

In the printed report of the "Proceedings of the Henrico Agricultural Society, for October, 1841," I see it stated by Mr. Turner that, from 21 head of horses, mules, cattle, and a considerable number of hogs, he had manured the preceding season 10 acres of land, at the rate of 25 cart loads per acre, (as gathered from a preceding portion of that report.) Now I can tell him that, on this estate, with an equal number of mixed stock and the mode of management here pursued, not less than one-third *more* than that quantity of land has this season been manured; and that from all sources, and these none other than domestic, since the month of November last, not less than 180 acres of land have been heavily top-dressed.

The stables for the horses and oxen occupy each one side of a large square, in the middle of which is a place of deposite for the manure, deepened in the centre, having a stiff and retentive clay bottom, gradually rising to its outer edges, around which there is a sufficient bank raised, and so formed as at all times to afford a dry and comfortable footpath all around the square. Both stables are thoroughly cleaned and swept out every day, and the floors plentifully sprinkled with ground gypsum, the probable benefit likely to result from the daily application and consequent mixture of which with the manure need not be here described. A regular and large supply of fresh litter in the shape of clean and dry wheat straw, and none other is used, is also daily applied. Amongst this manure no hogs are permitted to root, nor is the manure allowed to accumulate to any injurious extent, being hauled out as frequently as opportunity offers, and applied as a top-dressing to clover, at any period of the year, and always with decided advantages; and it is indeed a very rare circumstance to find amongst the manure any degree of fire-fanging.

Mr. Turner very pointedly refers to "the very large quantities of marl and burnt shells" used on this estate, but I think with an incorrect inference. The proprietor of this estate, his manager and many others in this neighborhood, entertain the perhaps singular belief, that putrescent manures can only be applied with permanent advantage on soils that are either naturally or artificially rendered calcareous. If there is error or fault in this belief, Mr. Editor, you have here, amongst your other *little* peccadilloes, a heavy account to answer for. I will here, however, aid you with one of *many* proofs of the correctness of the positions which you laid down as to the true operation of calcareous matters when applied to the soil. In the spring of 1840, a portion of land on this estate had a heavy application of putrescent manure. About 200 hhds. of shells were applied to one side of this manured land, the remainder then and now remaining unlimed. On the whole, corn was planted, followed by wheat and clover, to both of which crops the benefits from the lime were very obvious. This spring that portion not limed was again heavily top-dressed, and none applied to that which had been limed. The whole was grazed partially by sheep until the beginning of this month. From the limed portion we are now daily cutting a very good growth of clover, for the purpose of soiling, [feeding green,] while on that which had not been limed, but which had the benefit of an extra dressing of putrescent manures, there are only a few straggling plants of red clover to be found, with a tolerably close and low growth of white clover and natural grasses. Were a person to pass over these portions of land blindfolded, he could from the difference of growth tell when he came to the dividing line between the limed and unlimed land.

In reply to Mr. Turner's "set-off," to my objection to pen-feeding cattle, I will take the liberty of stating, that if he has "never been able to secure health and cleanliness by any other mode, "than by pen feeding, he has never properly practised stall feeding. And the case which he instances in his effort to fatten one of his steers is a proof of it; for no animal that is properly stalled and taken care of can by any possibility other than carelessness become covered by his own filth. Both modes I have seen fully tested, and under circumstances as favorable for pen feeding as Mr. Turner has adduced. The benefits of stall over pen feeding, for all animals which are required to labor daily, are I think very obvious. On this estate, all of the working oxen have been stalled when out of yoke, since the beginning of March last, when their stables were ready for their accommodation. And I am fully warranted in saying, that from their improved condition and efficiency for labor since that time, one fourth is added to their value, and of a

morning, as to any of their filth which adheres to them, Mr. Turner might pass his cambric handkerchief over both their flanks and sides without materially soiling it. Out of 30 oxen which have been regularly at work for the past ten months, several good beeves could *now* be selected, with skins as sleek and clean as could be desired; and I may also add, that these 30 oxen, with the aid of 4 others occasionally to relieve the weaker individuals, have executed all of the spring labor formerly performed by a number of animals varying from 42 to 48; and not a single instance has occurred of a steer failing to perform the daily labor required of him.

I now come to that portion of the reverend gentleman's remarks where he became "at once fully convinced that Mr. Nicol did not know against whom he was hurling his shafts." Let me here, Mr. Editor, compliment his sagacity in becoming "convinced" that I did not know who was the writer of an *anonymous* essay appearing in your pages. I had no intention of attacking his "strong forte," or his hog management, further than was implied in his mode of making them manure raisers, as gathered from his anonymous essay. Suited to his peculiar circumstances, his hog management, for aught I know, may be the very acme of perfection, and in his opinion I doubt not it is so. The price which he obtained for his eight months old boar was really good. But was it sold to the butcher or fancy hog breeder?

As to Mr. Turner's "one word more," I will not give insult, by believing that any of his intelligent neighbors would be guilty of so much rudeness as *to laugh* at any individual, however humble his station, or homely his mode of expressing himself, who would *honestly* express a dissent from the anonymous opinion of Mr. Turner or any other person.

The concluding passages of the remarks require no comment; their evident drift and intention is sufficiently plain; and with an apology for occupying so much more of your space than I had intended, I am, Mr. Editor, your humble servant,

A. Nicol.

It is unpleasant to us at all times to have controversy, on agricultural subjects, conducted between any of our correspondents in any other than the kindest feeling towards each other, and with the single object of eliciting truth by discussion. It has therefore been to us a subject of regret, that any asperity, or expressions that could give the slightest offence, should have found place in this controversy between two persons, to whose contributions we attach high value. Each, in turn, has thought himself aggrieved, and claimed the right to reply; and each has now been permitted to "shoot his bolt," or to "have the floor," in reply to the other's strictures, and though not as fully as he desired, to the full extent that we deemed admissible and proper. And now this controversy must stop here, or at least as to any thing farther that would apply to the person or the particular opinions of the opposite party. We have taken the liberty to prune from the articles, on both sides, some passages which were too pungent. For this we crave the pardon of both writers, and fear we shall have the thanks of neither; usually happens to the unlucky editor in such cases, we may have somewhat offended both the opposite parties, not only by what we have admitted, but also by what we have refused to admit. It is scarcely necessary to add, that the communications of both these highly respected correspondents, in support of their own opinions and practices, without too pointed condemnation of others, and whether on the points now in question, on any others, will be always most welcome to the pages of the Farmers' Register. —Ed. F. R.

WIND PUMP, FOR KEEPING LOW MARL PITS FREE FROM WATER.

To the Editor of the Farmers' Register.

I met with a gentleman from Eastern Virginia, more than a year ago, in the steamboat, who professed to be a farmer, and a subscriber to the Farmers' Register. He spoke of great improvements made by the use of marl, but said, in Mathews county, his residence, though marl had been found in many places, the land was so low and so flat, and water rose so near the surface, the use of it had not been attempted. I told him that I knew a farmer in the low lands of Talbot county, Md., who, under the disadvantages he mentioned, was working a pit much to his profit; and I promised, at his request, to make a communication on this matter in the Register.

Mr. John Dawson, the proprietor, informed me that after a painful search he found a bed of marl, on the banks of St. Michael's river, eight feet below the surface, and on a line with the river, and, upon removing the superincumbent earth, much water rose in the pit, which he drew off by means of a sweep and bucket, and worked in this way for some time. An uncommon high tide overflowed the banks of the river, and filled his pit. To clear it by the means he had been using, he deemed hopeless. Some person recommended to him to apply to Mr. O. Hussey, a skilful and ingenious mechanic of Baltimore, who constructed for him a pump, worked by the wind, which drew off the water. He still continues to use it, and the water now is no obstruction to his operations. By means of an inclined road he now gets marl with much facility. I saw the contrivance and was much pleased with it, and have no doubt but in Mathews, or in any other level country where the water cannot be drawn off by ditching, it might be advantageously used.

The cost of the pump, with the appendages, was one hundred dollars. If it should be deemed too expensive for one farm, by selecting a convenient spot it might serve for two or more.

I have forgotten the gentleman's name to whom

I have referred. If this shall come under his observation, he will see that, though the performance has been delayed, the promise was not forgotten.

WM. CARMICHAEL.

Wye, Queen Ann's co., Md., April 30, 1842.

NEW AGRICULTURAL SOCIETIES.

Two Agricultural Societies have recently been organized, one in the county of Prince George, and the other in King William, and both upon the *working* plan, recommended in the last December number of the Farmers' Register. The form of constitution there published, with a few changes of unimportant details, has been adopted by both these societies, and therefore it is unnecessary to publish the forms of constitution actually adopted. The plan requires that every member shall *do something* in furtherance of the objects of the institution, by accurately conducting and carefully noting, and reporting some one or more agricultural experiments each year. And if this be but done, the most unpretending labors of a society in any one year will serve to establish some useful truths; to indicate something of new practice, and beneficial and profitable to be performed; or something of old, useless or injurious, to be omitted and avoided; and this will be more than is generally done by other agricultural societies. But even the best devised plan of constitution and of operations for a society alone, will not be sufficient to make a society useful, unless the requirements of the plan be truly and faithfully obeyed by the members. We earnestly hope that there may be no such deficiency in these two societies; and they have our hearty and zealous wishes that their usefulnes and their success may entirely fulfil their design and objects.

REMARKS ON THE CULTURE OF INDIAN CORN, IN REPLY TO THE EDITOR OF THE CULTIVATOR.

From the Southern Agriculturist.

Dear sir.—In looking over the first and second volumes of the Cultivator, my attention was particularly attracted by the following editorial remarks on the subject of Indian corn and its culture, namely: "The roots grow to as great a length as the stalks;" and "In corn ground we think six to nine inches a suitable depth" in ploughing, as "the roots will strike fully to this depth if there is food for them."

Now, as there could be nothing more absurd than to maintain that a plant, five to ten feet high, has roots as long as itself, and that these roots go down perpendicularly, and yet reach no lower than eight or nine inches below the surface; the conclusion is obvious, that the editor believed in the horizontal distribution of the roots of corn as a general rule. Having had no opportunity of ascertaining, from personal observations, what the fact on this point is, in the soil and climate of that latitude, I notice this opinion of the Cultivator, not for the purpose of denying its correctness in so far as it may apply to that section of the union; but to show, that however well founded there, it is not altogether in accordance with facts here. And with this view, I shall state the general results of examinations of this plant, repeatedly made, in order to satisfy my own mind on this point.

It is not intended here to deny the existence of horizontal roots to the corn plant, (a fact with which every planter is no doubt familiar); but to call attention to the no less important fact, that these roots, however indispensable may be their functions, are not the principal in size, but are given off from other and much larger roots, which go down perpendicularly or nearly so, to a depth under favorable circumstances of several feet.

The plants first examined grew in a very light sandy soil, incumbent on a loose subsoil of yellow and white sand many feet deep. Here, upon carefully removing the earth to the depth of two feet, all the large roots were found running down perpendicularly; or at least so nearly so, as to be embraced in a circle of eighteen or twenty inches diameter, at a depth of two feet below the surface. More surprised at first, than satisfied with this discovery, I examined a number of other plants in the same manner, but with the same result; and was, of course, compelled to abandon the opinion previously entertained, that the main roots of the corn plant were all horizontal. These plants averaged about twenty-five perpendicular roots, some of which were traced two feet nine inches, when they were snapped off; and, upon comparing their diameter where broken off with that a foot above this point, it was evident they must have penetrated at least a foot deeper, making their entire length not less than three and a half to four feet. It should be remarked, however, that occasionally one of these large roots was found so bent in its course, as to run parallel with the surface: and further, that in one or two plants the majority of the roots diverged at such an angle, that they could not be strictly considered either perpendicular or horizontal. But these were plainly mere exceptions to the general rule. With regard to the horizontal or lateral roots, it was observed that the degree of their developement seemed to depend mainly on the condition of the soil, (properly so called,) and the season: Where the former was poor and the latter dry, but few of them, apparently, exceeded two or three inches in length, while many were much shorter. On the other hand, where the soil had been made very rich by high manuring, more especially if a wet season concurred, these roots were very much increased, not only in numbers but in all their dimensions, a large proportion of them extending from one to two feet or more from the stalk. All other things being the same then, these roots (the lateral) would seem to be developed on the one hand, in proportion to the fertility of the soil; and on the other, to the degree of humidity of the season; attaining their

utmost size under a concurrence of wet seasons and high manuring, and their least under the opposite contingency. There appear to be good grounds for believing, too, that wherever circumstances favor the growth of one of these classes of roots, that of the other is correspondingly retarded.

With a view to ascertain whether or not this disposition of the roots of the corn plant were affected by the texture of the soil and subsoil, several plants were next examined, growing in a close and heavy soil, based on a stiff subsoil, consisting principally of clay with some sand. But here, also, the same law was found operating in giving a downward tendency to the main roots. They were observed, however, to be more numerous, and to reach an average depth of only two feet, their progress downwards, being no doubt obstructed by the resisting quality of the subsoil. The horizontal roots, though of smaller diameter than the perpendicular, were so much more developed than in the former case, especially when favored by a moist and mellow soil, as to traverse and occupy the entire intervals (a space of five feet) between the rows.

The results of the above examinations certainly go to show, then, that the opinion of the Cultivator is not in strict harmony with facts, at least in this locality: that, in short, the principal roots of the plant under consideration, so far from penetrating only eight or nine inches below the surface, actually reach a depth of several feet; while the horizontal, which that journal seems to regard as the principal roots, are, in point of fact, smaller (though often longer) ones given off from the former. It has been seen, moreover, that the relative dimensions of these two sets or classes of roots are not always the same; their respective developements depending, as they do, on the controlling influence of the several ever varying causes enumerated.

We cannot reflect on the foregoing facts without at once perceiving, and, in some degree, appreciating their practical bearing. Nor can any one, acquainted with the habits of this plant, fail to discover the wise adaptation of means to the end displayed in the number and position of its larger roots. One happy and very obvious effect of this arrangement is, a degree of exemption from the effects of drought, which could not be enjoyed under any other. Hence it is that corn, although so susceptible of injury from this cause, does not suffer more from it. For it cannot be questioned that, with its present physiological constitution unchanged, the harm it would sustain would be much greater were its roots horizontally placed, and of course near the surface. Indeed, this fancied position of its roots can never sufficiently account for the readiness with which this plant suffers from drought. This phenomenon is clearly referable to nothing else than the organization of the entire plant itself. The most obvious of its features—its size, the well-known porous structure of its stock and leaves—its rapid foliar transpiration, &c., sufficiently indicate the need of a quantity of sap both absolutely and relatively large. Now, as water is essential to the formation of sap, and constitutes such a large proportion of it, it would seem evident that this plant, which contains so much sap, must require a corresponding quantity of water, and must suffer sooner for the want of it, than if its relative portion of sap were much less.

Indulge me here, Mr. Editor, with a remark or two on this point relatively to the cotton plant. Its capability of resisting drought has been attributed, in a published communication, to its tap-root. This, it is supposed, by penetrating to a great depth, furnishes a supply of moisture sufficient to enable it to withstand a drought, by which corn would be seriously injured if not destroyed. In order to determine the truth in this matter, I have pulled up and examined a great many plants after the 15th or 20th of July; but have found a large proportion of them with no tap-root at all: while in others this root had either assumed a lateral direction, or had become so diminutive in size, and inferior to the lateral, as to be evidently incapable of the effect above ascribed to it. Yet these plants were as little affected by drought and as productive as the tap-rooted. Now if the latter resist drought by virtue of their tap-roots, by virtue of what do the non-tap-rooted plants resist it? Were it this root alone that conferred immunity from the effects of a dry season, one might expect during such a time easily to distingnish between them while growing; but this, it is believed, cannot be done; and it is more than probable that the relation of this plant to the season is as little controlled by its tap-root as that of the corn plant is by its horizontal roots. The former, whatever may be its degree of succulency, becomes gradually more and more woody, until at maturity, it acquires the closeness of texture and hardness of many shrubs. While, on the other hand, the stalk of the latter is more or less occupied by a pith so filled with sap that it may be wrung from it almost as water from a saturated sponge. Were equal portions, by bulk, of cotton and corn-stalk, at the same period of their growth, deprived of their sap, the quantity from the former would doubtless be much less than that from the latter: for the very obvious reason, that the dense and compact structure of the one is incompatible with that capacity for sap existing in the very light and porous pith of the other. Hence it would seem safe to conclude, that cotton, containing, as it does, less sap, requires less moisture than corn; and is, of course, better able to sustain itself during drought, even supposing the relative activity of the leaves to be the same in both plants. This opinion is corroborated by the effects of the great drought of 1839 on some of our forest trees situated in certain high and thirsty localities. The oaks, so far as I observed, exhibited no evident symptoms of injury, while the pines growing among them lost, in some instances, a moiety of their leaves. Here then the case of cotton and corn is reversed; the tap-rooted plant suffering least in one case, and most in the other. This, it is conceived, can only be explained by reference to a difference of organization; the result of which was, that the pine, though fortified by an immense tap-root, became the earlier and greater sufferer. * * * * * * *

L. Reeve Sams, M. D.

INTERESTING TO COTTON GROWERS.

From the Memphis Enquirer.

Panola Cy. (Miss.) Jan. 26, 1841.

Mr. Editor,—It is usual for cotton growers to sun their cotton as they gather it, and then gin it as early as possible. This, according to my judgment and experience, is clearly wrong. Cotton should never be sunned, unless it be such as has been gathered quite wet with rain; nor should it be ginned until it has been heated.

Heat diffuses oil, and we know there is a large quantity in cotton-seed. Now, sir, put it together as you gather it, both morning and evening, and there is sufficient moisture to make it heat. This being the case, the oil in the seed is diffused throughout the lint—for it cannot evaporate. When it remains in this situation a sufficient length of time to spoil the seed, the cotton should then be thrown up and cooled. Care should be taken not to let it turn blue:—this, however, is not so easily done as you might suppose.

The process of turning over and throwing up will likely have to be repeated two or three times before the seed are entirely spoiled. The trouble of overturning and tossing it up in the cotton or gin house is not greater than sunning it on a scaffold. By this process you gain the weight of the oil which is diffused throughout the lint, and which gives the cotton the oily gold color which is desirable, and also that elasticity and adhesive quality, like wool, which never fails to enhance its value.

But, sir, there are other advantages growing out of this operation: the gin will pick at least one-sixth faster, and clean the seed much cleaner when the cotton has thus been compressed together; and instead of cutting off short particles, as is always the case when the cotton is open and fresh, the saws take it off in large flakes, thereby making the staple longer and stronger.

Every farmer knows that his early cotton outweighs, and has better staple than his late cotton; and he also knows that the earlier it is gathered after it opens the better. Now, sir, these facts show the correctness of my theory; for exposure to the sun and rains evaporates the oil from the seed and makes the lint short and light.

Farmers should secure in dry weather and from evening pickings, in a house to itself, or a portion of the gin, sufficient of dry good cotton, to make seed, but the balance of their crop they should be sure to subject to the process of heating and cooling in the shade. It is said that the British East India cotton is vastly inferior to ours at present. If we can make our cotton still better, the danger from that quarter will be lessened.

ASPARAGUS.

From the British Gardener's Chronicle.

A few weeks since, we reported briefly the substance of a paper upon the cultivation of asparagus in the north of Spain, which was communicated to the Horticultural Society by Captain Churchill, of the Royal Marines. This gallant officer was at St. Sebastian during its occupation by General Evans; and he profited by such leisure as his military duties afforded him, to make himself acquainted with the natural history and horticulture of Guipuscoa. We might content ourselves with merely referring the many inquirers who want to know how to grow asparagus well, to the report just alluded to; but in our opinion it is much too important to be passed with so little attention.

Asparagus is probably the vegetable most generally admired and most seldom well cultivated; it is only here and there that it is large, tender, and delicate. In country gardens it is small, green, and strong; in the London market it is long, white, hard, and tough—to the eye attractive enough, but to the taste more like bleached timber than an esculent. Indeed, we have never been able to comprehend the reason why, in this our age of improvement, some ingenious turner has not produced imitation sticks, which might be tipped with half an inch of eatable asparagus, and thus spare the necessity of cooking four-fifths of the stuff that is brought to a London table. Covent Garden asparagus is assuredly the worst in Europe. For this reason, when really fine asparagus is met with, people think it must be some peculiar sort—obtain the roots from Vienna, Berlin, Hamburgh, Battersea, or Deptford, and then, when they find them producing heads identical with what they had before, lay the blame to the seedsman, or the soil, or the climate, or any thing rather than their own want of skill. There is but one sort of asparagus, be its name what it may; all the difference consists in its cultivation.

Captain Churchill says the Guipuscoan asparagus measures from three to six and more inches in circumference. How this is obtained, his excellent account leaves no room to doubt.

Asparagus is a plant found naturally on the beach of various parts of the coast of Europe, where it is covered by the drifting sand, and watered by salt water at high tides. Sand and salt water occasionally may, therefore, be regarded as indispensable conditions for maintaining it in health. How seldom is this thought of! It, however, explains in part the excellence of St. Sebastian asparagus.

It seems that at the mouth of the Urumea is a narrow slip of land, about three feet above high-water mark, consisting of alluvial soil and the wearing away of sandstone hills, at whose foot it is placed. This is the asparagus ground of St. Sebastian. Beds are formed five feet wide, without any previous preparation except digging and raking. In March the seed is sown in two drills, about two inches deep, and 18 inches from the alleys, thus leaving a space of two feet between the drills. The rows run invariably E. and W.—doubtless in order that the plants may shade the ground during the heats of summer. When the seedlings are about six inches high, they are thinned to something more than a foot apart. Water is conducted once a day among the alleys and over the beds, so as to give the seedling an abundant and constant supply of fluid during the season of their growth. This is the cultivation during the first year.

The second year, in the month of March, the beds are covered with three or four inches of fresh night soil from the reservoirs of the town; it remains on them during the summer, and is lightly dug in during the succeeding autumn; the operation of irrigation being continued as during the

first season. This excessive stimulus, and the abundant room the plants have to grow in, must necessarily make them extremely vigorous, and prepare them for the production of gigantic sprouts.

In the third spring, the asparagus is fit to cut. Doubtless all its energies are developed by the digging in of the manure in the autumn of the second year; and when it does begin to sprout, it finds its roots in contact with a soil of inexhaustible fertility. Previously, however, to the cutting, each bed is covered in the course of March very lightly with dead leaves, to the depth of about eight inches; and the cutting does not commence till the plants peep through this covering, when it is carefully removed from the stems, in order that the finest only may be cut, which are rendered white by their leafy covering, and succulent by the excessive richness of the soil.

In the autumn of the third year, after the first cutting, the leaves are removed, and the beds again dressed with fresh night-soil as before; and these operations are repeated year after year. In addition to this, the beds are half under salt water annually at spring tides.

Let any one compare the mode of culture with ours, and there will be no room for wondering at the difference in the result. The Spaniards use a light sandy soil; we are content with any thing short of clay. They irrigate; we trust to our rainy climate. They know the value of salt water to a sea coast plant; we take no means to imitate nature in this respect. They dress their beds with the most powerful of all manures; we are contented with the black residuum of a cucumber frame, which is comparatively a *caput mortuum*. Finally, they throw leaves lightly over their beds, by which means they expose the young sprouts to the least amount of resistance, and force them onward by the warmth collected from the sun by such beds of leaves; we, on the other hand, compel the asparagus to struggle through solid earth, capable in the smallest possible degree of absorbing warmth during the day—but, on the other hand, ready to part with its heat again at night to the greatest possible amount.

Can any one wonder, then, at the poor results obtained by our manner of cultivation?—or that some gardener should now and then astonish his neighbors by producing asparagus which we call giant, but which at St. Sebastian would be called second rate?

THE ARTESIAN WELL OF GRENOBLE.

From the Mining Journal.

At Grenoble, in the vicinity of the French capital, it was considered advisable some years ago to endeavor to procure good water by means of an Artesian well. M. Mulot d'Epinay was the engineer to whom the task was entrusted. On the 31st of December, 1836, the bore had been carried, after immense labor, to the depth of 383 metres, (a metre is 3 feet and 2-10ths English.) The soil was a clay, very hard and compact. In the month of June, 1839, the bore had reached the depth of 466 metres, and the soil was still a bed of clay, though a variety of strata had been previously passed. M. Mulot kept a regular journal of observations relative to the soils and strata penetrated, and the temperature at different depths. This record will be valuable when published. At length, after a task of seven years one month and twenty-six days' duration, M. Mulot was rewarded by a degree of success proportioned to the time and trouble expended. Water was not only found, but found under such circumstances, and in such quantities, as will cause the well to be one of the most useful works as well as one of the greatest marvels of artistical ingenuity in France. The fluid burst out in a perfect torrent, rising to the surface of the bore to the amount of nearly three cubic metres in a minute, or 180 metres in an hour, and 4320 metres in the twenty-four hours. Such is the force with which it flows up the shaft, that it mounts more than thirty-two English feet above the surface of the ground. Mr. Hemery, director of roads and bridges, has calculated that the force of ascension of the water, at the bottom of the shaft, exceeds, by fifty times, the force with which water rises in a vacuated tube of thirty-three feet. The orifice of the well is fifty-five centimetres (about one foot eight inches) in diameter, and at the bottom it is eighteen centimetres in diameter. The shaft is in all 547 metres (or 1630 French feet) in depth, and the sides are strongly plated with iron to a depth of 539 metres. The dome of the Invalids, which has an elevation of 300 feet above the ground, is thus only about a fifth of the perpendicular measurement of the Artesian well of Grenoble.

Three times, during the operation, did the shaft give way, but the indefatigable engineer was not daunted, and at last he has had his reward. The water, which the well pours fourth incessantly, has converted one of the neighboring streets into a river, but the workmen are at present employed in forming a channel for its proper conveyance from the spot. As might be expected, the fluid was at first mixed with sand and earth, and continued to be so for some time. It is perfectly sweet, however, and had no odor of a disagreeable kind, or any other deteriorating qualities. It is of such a temperature, that there is an obvious smoke arising from it when it reaches the surface. This is a feature not likely to continue, and indeed easily removeable before use. The whole cost of this great work of art to the city of Paris is said to have been 160,000 francs. The perseverance in this labor for such a period of deferred success, is to be ascribed to the confidence resulting from modern geological discoveries; and the value of these is most splendidly shown by the success attained. By an ingenious contrivance, M. Mulot has been able to raise large quantities of sand from the bottom of the well; thus clearing the water more rapidly, and also adding very considerably to its force and volume. This removal of the sand has been attended with curious consequences in more respects than one. After ceasing, in a great measure, to throw up sand, the well has begun to throw up shells and petrifactions of various kinds, the debris of a former world. The success of the operations at Grenoble has also induced engineers to make similar attempts in other quarters. One is begun on a large scale at Vienna.

EXTRACTS FROM A REPORT TO THE STATE BOARD OF AGRICULTURE.

By Edmund F. Noel, of Essex county, Va.

ON LIVE-STOCK AND FRUITS.

The Virginia Board of Agriculture, at their first meeting in December last, agreed upon certain queries to be propounded to the most intelligent and experienced farmers and planters in the state, stating that no one individual would be expected to reply to all, but only such as he should best understand. As one of the circulars of the Board containing the queries has been addressed to me, I will proceed to cast in my mite, hoping others may do the same, and that much valuable and useful information may be obtained.

8th Division of queries.—Live-stock.

Our breed of cattle, with few exceptions, is mostly of the native breed. Mr. Coke, of Norfolk, England, sent to Messrs. Patterson and Caton, of Baltimore, some Devon cattle in 1817, and in 1825 I purchased a pair of calves of Mr. Caton at $250. I crossed them upon my cattle of the native breed. The cross I thought was superior to either breed. Many of the oxen lived and worked for me more than ten years, and performed well. Along with them the most of the time half Durham oxen worked: the cartmen were of opinion the half Devon oxen were much the best.

Durham cattle.—In 1828 I purchased of Col. J. H. Powel a Durham short-horn male calf, at $300, and crossed upon my cattle of the native breed. The cross was larger and finer than the Devon cross; but whether they were larger and finer in proportion to the food consumed, I do not know. The animal I bred from was probably superior to most of the Durham cattle. His sire and dam were imported from England by Col. Powel; and he bred from his sire, instead of other males imported by him. His dam, with twenty other Durham cattle, was exhibited at the Pennsylvania Agricultural Society the year before I got the calf, and by the society was pronounced second best. Col. Powel afterwards raised a male calf from her by the same sire, for his own use; which animal he afterwards sold to a gentleman in Kentucky, near Lexington, for $1000. I make this statement of facts so as not to mislead any person. An inferior animal of the Durham breed might have given a different result. I have had a chance of seeing a great many fine cattle in different parts of the United States; and, my life being entirely that of a farmer, I have taken much pleasure in looking at them. Many years past I saw the Devon cattle then in the neighborhood of Baltimore. Some years after I saw, near Philadelphia, Col. Powel's large stock of Durham cattle, a few days before his great cattle sale. Since which I have had a chance of seeing in Kentucky and Missouri a number of fine cattle of different breeds and crosses, but I have never seen finer oxen than I have seen in Mississippi, in the Choctaw purchase, of the native breed. I became a planter in that part of the state soon after its settlement, and I have spent many winters there. For some years after its settlement, nearly all the cotton was carried to market in ox-wagons, and during the time of delivery, it was nothing uncommon to see in a day several hundred oxen on the road leading to Manchester, (now Yazoo city,) and no person could behold them without admiring their size and beauty. Grass was then plenty, and they were fat the year round. The great error in lower Virginia is that of keeping an overstock of animals. Under such management no breed will be an improved breed long, nor an improved cross.

Sheep.—Our breed of sheep, like our breed of cattle, with few exceptions, is mostly of the native breed. Fine-wool sheep with us will not answer; we want coarse wool to manufacture in our families; and under our system fine wool is filled with trash, and will not do for market.

Bakewell sheep—called Bakewell after the fabricator of the breed, Dishley after his farm, and New Leicester after the part of the country in which he lives. This breed is hornless, white face and legs, wool long, just such as we want in our families for coarse fabrics; constitution tender; remarkably docile, more so than any sheep I have ever seen. For beautiful form and great propensity to fatten this breed is supposed to be unequalled. Numbers of this breed of sheep have been imported into the United States since our last war, and they have taken nearly all the premiums offered for coarse-wool sheep; lots of them have been slaughtered in our large towns to the north, averaging over twenty pounds of tallow per head, and small lots of them have averaged over thirty pounds per head. For a number of years I have had only half Bakewell sheep upon my farm, a cross on the native breed, with which I am very much pleased. But I have occasionally had a few pure Bakewell sheep, the cost of which $20 per head. But they did not appear to do as well as the half breed; they were more subject to disease, and not disposed to ramble over the farm as much in search of food. But where food is plenty, and they are well taken care of during the winter, I should suppose the pure breed greatly to be preferred.

Southdown sheep.—Hornless, speckled face and legs, wool short and fine, of a hardy constitution. Many years past I purchased two ewes of this breed, then with lamb, at $30 each. I was induced to make this purchase from the high character given to this breed of sheep, and particularly this family of them, by gentlemen in Philadelphia. See American Husbandman and the American Farmer, vol. 7, page 361. I am thus particular, lest it may be thought this family of Southdowns were not of the pure breed. I found them to be a hardy breed of sheep, with no greater propensity to fatten than the common sheep of our country, and their mutton no better; the quantity of wool very small, about what English writers state it to be in England, two and a half pounds per fleece. This breed of sheep proved the most unprofitable of any I ever had upon my farm.

Hogs.—Our hogs have been crossed by various breeds. I have myself purchased some from Connecticut, New York and Pennsylvania. Those I got from Pennsylvania I got of Mr. Barnitz. This breed was the best I ever had upon my farm; they were not of the breed described in the American Farmer, vol. 13, page 279, but a cross upon that breed, which he afterwards made. I cannot now lay my hand upon his letter, but, as well as I now recollect, he stated it to be a cross of the Chinese and Chichester breeds. Some years past

I got of Mr. Bement, of Albany, New York, a pair of Berkshire pigs. They did not come up to my expectation; their descendants were still worse; and, supposing they were in a state of degeneracy, from breeding in-and-in too closely, I determined to give them a cross, which was done with the following family of Berkshires.—(New York Cultivator, vol. 5, page 138.)

Berkshire pigs.—Messrs. Brentnall, of Canterbury, Orange, who have a stock of these pigs, from original importation, cite the following as the weights to which they have attained, at the ages noted: one, under two years old, weighed 652 lbs., one four years old, 702 lbs., one three years old 780 lbs., two eighteen months old 432 and 432½ lbs.," &c. The animals of this cross are now nearly grown, and are better than the Bement was, but nothing to justify what has been published in this country respecting the breed.

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13th Division of queries.—"Miscellaneous observations and statements of any thing of interest, not included in any query."

Under this division I will make some remarks on fruits, &c., without any arrangement of matter, and confine them to apples, pears, peaches and grapes. The number of different varieties of fruits now offered for sale in the United States is very great—of apples, pears, peaches and grapes, several hundred varieties. When such vast numbers are to be disposed of to inexperienced farmers, and scattered over the country, it is much to be regretted, there are but few which are of superior quality; and a few of these, judiciously selected, would supply the wants of a private family. Our apples and peaches are mostly of those kinds cultivated by our fathers, for the purpose of making spirits for market, which was common in those days. Our orchards at present have an unsightly appearance. The influence of the temperance society is very injurious to orchards. It is always on the ebb or flood; one year the caterpillars are suffered to eat up the orchard; another, the orchard is trimmed up and worked; one year the stills are pulled down; another, they are rebuilt, and the harvest gathered in with a shout. To avoid the too common error of the world, of telling others what they ought to do, and doing nothing themselves, I will tell what I have done, and the errors and difficulties I have had to encounter, that others may avoid them. In early life I purchased the plantation on which I now live. It had been held for a number of years as a life estate, and many parts tenanted out; and was just such a place as one would have expected to see. Some half a dozen apple trees, and a few old peach trees above the reach of cows, were nearly all the fruit trees upon the farm. Wishing a good orchard, I purchased 300 apple trees, of an individual in this part of the country, and planted them out. Shortly after which I purchased an excellent treatise on fruit trees, that had just been published, by Mr. Coxe of Burlington, New Jersey, with descriptions of the finest varieties of fruits, illustrated by cuts of two hundred varieties, of the natural size; and having moved from that part of the farm where I had planted the first orchard, to a more central one, I determined to plant another orchard, and to give the trees of the first one away. The second orchard was planted of the finest varieties of apples recommended by Coxe, and all the trees obtained from New York, with the exception of some few kinds we had in the neighborhood. At this time I had a farm some few miles from me, on which there was an apple orchard that had been in bearing a few years. I determined to graft it with some of the finest varieties I had just got from the north. For that purpose, I had about half of the large limbs cut off a little ways from the body, near the first fork of limbs. The other limbs were left to keep the trees alive, that part of the limb left that was off, that had water sprouts, was then grafted. And those that had no sprouts were left to throw them out, to be grafted the ensuing spring; the other large limbs left were the ensuing spring cut off and grafted in like manner. The grafts that lived, had a split or piece of bark tied around to know them; and as they grew, the water sprouts were trimmed to give room. The grafts inserted bore a little the second year, and in five years they bore a good deal, and the tops of the trees looked large and fine. But some of the trees were very much injured by cutting the large limbs too near the body; decay extended from the cut through the limbs to the body. Limbs, in proportion to their size, should be cut farther from the body, large limbs several feet, and tar should be rubbed on the end of the limbs. It in a great degree prevents decay, but too much is an injury; it runs down on the bark in hot weather and scalds the bark. After the trees had come to bear a few years, I found most of the varieties did not suit this part of the country, and had to regraft nearly all my young orchard, one half of which was planted of the green Newtown pippin. This has long been considered the finest winter apple known. It bore well with me, but about the time of ripening nearly all would speck and rot on the tree. Some of the other kinds were no better. The following kinds I prefer; they have been bearing with me for many years; I will name them in the order they ripen. June-eating, Prince's harvest, a small yellow apple, summer pearmain, yellow bellflower, and Carthouse.

June-eating.—This is the earliest apple of our country: size small, form flat, color yellow, flavor pleasant, the skin of an oily feel.

Prince's harvest.—About two or three times as large as the June-eating, and something of the same form and color; fine to cook, but not good much in other respects.

A small yellow apple.—A seedling of this neighborhood, the size of a common crab apple; the form flat, flesh remarkably tender, rich and of delightful flavor, and an excellent fruit to cook. It bears only every other year, then abundantly; it ripens slowly. It is to be regretted that such an excellent apple should be so small, and to bear only every other year.

Summer pearmain. This is one of the very finest summer apples of our country; the size large, with us much larger than the cut in Coxe's Treatise on Fruit Trees. The color a reddish yellow, with streaks and spots of deep red; juicy until too ripe; the flesh very tender. It frequently cracks open on the tree and bursts from its own weight in falling. It is a fine apple to eat or to cook; it is free from rotting; ripens slowly

and lasts for a long time; it bears every year, but has its full and scanty years of bearing.

Yellow bellflower.—At a little distance from this apple, it has the appearance in size, form and color of the common quince of our country. It is an excellent apple to eat, or to cook; the flesh is rich, juicy and tender. It bears every year, and is one of the most productive apples of our country. The tree grows large and spreading, with pale leaves and hanging boughs. There is another apple, that should not be mistaken for this—the monstrous bellflower, a worthless apple, with fruit in appearance resembling the yellow bellflower. The difference in the growth of the trees is easily told; the monstrous bellflower has upright limbs, with very large foliage of a deep green. Some varieties of apples seem adapted to particular localities, whilst others seem to retain their excellence over a much greater extent of country: this appears to be the case with the yellow bellflower. It is represented by Coxe as "the most popular apple in the Philadelphia market;" and in the New American Gardener, published at Boston, a writer says, "This apple we can decidedly recommend from twenty years trial; it is a great bearer." But I do not think it as large here or as fine as I have seen it to the north; probably it would not do to cultivate much further south. This apple is considered a native of New Jersey.

Carthouse.—This I prefer as a winter apple to any other I have ever had under cultivation; it is an excellent apple, very productive, and bears every year. The following is Coxe's description of it: "This apple is said to have been brought from Virginia; it obtained its name from a family in the Delaware state. It is highly esteemed for its excellence as a table apple late in the spring, and as a good cider fruit. It is a most abundant bearer, and hangs on the tree very late in the season. The tree is hardy, of a handsome, open, spreading and vigorous growth. The fruit is small, the color a deep red, sometimes a little streaked with yellow; the skin of a polished smoothness; the form inclining to an oblong; the flesh is very firm, yellow, and rich, not fit for eating until mid-winter, when it becomes juicy, tender, and finely flavored." Coxe says this apple is small, but the cut he gives is over the common size with us; it may be said to be an apple of the common size, except when the trees are over full. The Carthouse, when gathered with us, are put in barrels or boxes in the cellar without any thing with them; in this way they keep until they are used. A cool dry cellar is the best place to keep apples, in fact they cannot well be kept any where else, without soon becoming dry and tough. I have read much that has been published on fruits, and I have taken much interest in this matter, and having frequently to pass from here to Mississippi, by the way of Baltimore, Cincinnati and Louisville, I have frequently gone to market, and to the fruit shops to examine the fruits, and from what I have seen, and trials I have made with many varieties, I have come to the conclusion, that were I to cultivate only three varieties of apples in this part of the country, I should cultivate the summer pearmain, yellow bellflower, and the Carthouse. These three varieties would give a succession of fine fruit from some time in August, until the ensuing spring, and would be more apt to bear annually than most other varieties. To persons wishing to cultivate a greater variety of apples than I have named, and who may be inexperienced in such matters, I would recommend the following varieties for trial: red June-eating, summer green, Roane's crab, wine apple, James river, black coal, and Gravestein. Red June-eating is said to be a fine early apple; with me it has not yet borne.

Summer queen.—This is represented by Coxe and others as very fine. I was under the impression, for some years, this variety was in my orchard, but it proved otherwise. I have since obtained a tree from the north for this variety, but as yet it has not borne. It is said to be a large apple, yellow color, with stripes and clouds of red, and "equally suited for eating and stewing."

Roane's crab.—Coxe states this apple to be a native of this state; that it originated on the farm of an individual whose name its bears. He says "it is an early and a great bearer every second year; the apple is small," "the form is round, the stalk thin, the skin yellow, with a small portion of russet about the stem, and spots of red scattered over it." "The liquor is remarkably strong, of a sirupy consistence when first made, but becoming singularly bright by proper fermentation and racking. It will keep perfectly sweet in casks well bunged, and placed in a cool cellar, through our summer months." I have frequently eaten this apple; it is only tolerable. Many years past I occasionally had a chance of drinking some of the cider; I thought it the best I had ever tasted. Persons wishing to raise cider of a superior quality should give this apple a trial.

Wine apple.—This is a very fine fall and winter fruit, and has succeeded in this neighborhood very well. The fruit is large, form flat, color red, streaked and spotted with small portions of yellow; the stalk end frequently of a russet color. The tree grows large, leaves small. This kind should not be mistaken for the winesap.

James river.—I know nothing of this variety; but I have seen it highly recommended as a winter apple.

Black coal.—A large red winter apple; this with me has not yet borne.

Gravestein.—A small winter apple. The two last varieties named, were introduced into this country a few years past, and are represented as very fine north of us; but experience must prove whether they are adapted to our part of the country.

Pears.—In early life I have purchased many varieties of pear trees, from the finest northern nurseries. I was then under the impression, it was like writing to a neighbor for a bushel of corn or wheat—what was written for would be received; but in this I was greatly mistaken. But for this, I could say much more on pears than I now can say. From what I have seen, and from what has been published, I should consider the following varieties the finest: green chisel, or Madeline, early Catherine and English Gargonelle, or summer bell. These are said to ripen before the peach. Seckle, a summer pear; yellow butter or St. Michael, a fall pear; Echasserie, a winter pear.

Green chisel, or *Madeline.*—I raised four trees of this variety, which bore with me for several years, but the blight which is so destructive to the pear trees of our country killed them all. This variety of the pear, I think, will not succeed well as far south as this.

Early Catharine.—I purchased a tree for this kind many years past, but when it came to bear it proved to be the green Catharine. I have since purchased another for the early Catharine, which has not yet borne with me. Coxe says, "this is more generally admired than any summer pear; it is remarkably fine, rich, waxy and luscious. Its form somewhat like a calabash, with a long curve neck, and a long fleshy stem; the skin is on one side yellow, the other a rich russet or brownish-red." Coxe's cut of this pear, exclusive of stem, is 2¼ inches in length, its greatest breadth 1⅜ of an inch, which is about ¾ inch from the blossom end.

English gargonelle, or *summer bell.* This variety has not borne with me as yet. Coxe says, "it is a tolerably large pear," "with a neck somewhat curved, and diminishing to a small point, with a long stalk, fleshy towards its junction with the fruit, the skin is a light green, with small cloudy spots, blended with russet, particularly near the stem, the cheek next to the sun has frequently a brownish-red color." Coxe's cut of this is about 2⅜ inches in length, its greatest breadth 1¾ of an inch, which is about one inch from the blossom end.

Seckle.—This is considered the finest pear known, and is supposed to have originated in the vicinity of Philadelphia, and is called after the name of the individual on whose farm it is supposed to have originated. Coxe says, "the form and appearance vary with aspect, age and cultivation, the size generally is small, the form regular, round at the blossom end, diminishing with a gentle swell towards the stem, which is rather short and thick; the skin is sometimes yellow, with a bright red cheek, and smooth, at other times a perfect russet, without any blush." "The tree is singularly vigorous and beautiful, of great regularity of growth and richness of foliage; very hardy, and possessing all the characteristics of a new variety." Cox's cut of this is about 2⅜ inches in length, its greatest breadth 2¼ inches, which is about an inch from the blossom end. I have two trees of this variety that have been in bearing for some years; they have been very healthy and productive, and not injured in the least by the blight. But with this pear there is a drawback that I have not seen noticed by any writer. About the time of ripening, storms beat down great numbers of them; they generally have broken stems; probably the limbs, which grow close and thick, are forced with too much violence against them; the stems may also be more brittle than usual. As they fall so they remain, never becoming any riper.

Yellow butter and St. Michael.—This is considered in excellence next to the Seckle, and a much larger pear, though Coxe has given cuts about the same size. However, this error may be considered corrected, as he calls it a large pear. This pear is said to be better when gathered before it is ripe and housed. I cannot say how this is, but I have eaten some very fine ones that storms had beaten down several weeks before the time of ripening, that had been housed. It is said to be "a never-failing and abundant bearer, and produces fruit at an early age. The tree is of small size." I had two trees of this kind, that bore with me for several years, but lost them both by the blight. I think it probable trimming caused their death. "From the great vigor and rapidity of the vegetation in America, pear trees, if much pruned, are apt to grow too fast. This appears to render them more liable to the effects of the fire blight than otherwise they would be."

Echasserie.—This pear has been extensively cultivated in our country for a great number of years, and is represented as an excellent pear, hardy, very productive, and bearing abundantly at a very early age; it is rather a small pear. Years past I purchased a tree, for this kind, but it proved otherwise. I have now some few trees grafted from a tree of this kind, owned by an acquaintance of mine, who is very much pleased with it. Mr. Prince says, Coxe erroneously calls it the ambrette. Coxe says the ambrette, "when ripe, is green; the skin rough with small russet spots, and some black clouds. Neither the crown nor stalk end is indented. The flesh is rich, juicy, and highly flavored." Coxe's cut of the ambrette is 2⅝ inches in length, its greatest breadth nearly 2¼ inches, which is near the middle. I have been more particular in the description of pears than I should otherwise have been, in consequence of their being very subject to the blight, for the pear-tree cannot be regrafted, like the apple, without running a great risk of losing the stock by the blight. I have planted out a good many quince stocks where they are to stand, and recently grafted the Catharine and Gargonelle to them, a little below the ground. Coxe says the pear "will take on the quince either by inoculation or ingrafting. The former mode performed above ground will produce dwarf trees; the latter mode, under ground, in the root, will in some varieties improve the pear; in all it will form a strong vigorous tree." The quince is much used for ingrafting summer tender pears, and for espaliers; they do not suit winter pears so well, as they are apt to crack." Another author says, the pear ingrafted on the quince "has the property of giving to the fruit it bears greater precocity, an increased size and improved flavor, but with this drawback, that the quantity is small, and product short-lived, as the age of the tree seldom exceeds ten or twelve years."

Peaches.—The first peach orchard I ever planted was made up of the finest varieties I could obtain in the neighborhood. The site was fixed on, and the holes dug, four feet deep and four feet wide, and filled up with two ox-loads of rich earth, mostly from the adjoining woods; the other earth used was rich earth from under some old peach trees. This earth was used after I left home in the morning, under the impression it was richer than the other. On my return home I found what had been done, and anticipated the result. I had read enough to know that the site of an old orchard was not a proper place for a new one of the same kind; and in this case I thought it would be much worse, as the earth was put in the very holes in which the trees were to stand. However, as I was not very partial to the site, I determined to plant the trees, and see the result. The trees were planted, and in a few days there came a heavy rain, and the earth in the holes sank very much, though it had been partially trodden. The trees sank so low, and were so much thrown out of a line, they had to be pulled up and replanted, and before the ensuing year a good many died, others looked sickly, and some were quite flourish-

ing. Wishing to have nothing more to do with this site, for an orchard, I had the trees pulled up, and thrown away, and determined to plant another of the finest varieties known in our country, at least as far as I could get information on the subject, to enable me to make the selection. I found it necessary to read the best treatises I could get on fruit trees; and in 1824, I ordered a good many varieties from a large nursery in New York, and in 1826, I ordered 100 trees of 17 varieties, mostly 7 trees of each variety, from a large nursery in New Jersey. With these I planted another orchard, and looked forward with pleasure to the result. But after it had borne a few years, I found it was more in want of an axe or a grubbing hoe than any thing else—there were so many unprofitable varieties: since which I have used the axe and hoe freely. Some of our largest and finest peaches are amongst the most unprofitable to cultivate. Within the last two years, I have brought under cultivation nearly all the first-rate peaches known in our books and catalogues, that I had not tried before, with a view of making out a fine and profitable succession, the season through. Of these varieties I cannot now say any thing, but of those varieties that I have long had under cultivation, I prefer the following:

Red Magdalen and *red rare-ripe* are very fine early peaches.

Oldmixon cling-stone (sometimes called red Catharine) is a large peach with a red cheek, and is one of the very finest peaches of our country, and one of the most productive. It ripens immediarely after the two just named. This variety is said to be cultivated in the vicinity of our large towns to the north, to supply the market. About two years ago, while in Baltimore, I had some conversation with a gentleman who owns a large nursery near town. He stated to me he had an acquaintance, who had supplied the Baltimore market with peaches on a large scale, for the last thirty years, and he told him he considered the Oldmixon cling-stone the most valuable peach he had.

Oldmixon free-stone.—A fine peach. It resembles the Oldmixon cling-stone in its external appearance, and ripens about the same time; but in other respects is not to equal it. I am rather inclined to think another peach can be substituted for this in a succession of peaches for this part of the country; however, as yet, I have been compelled to retain it.

Columbia, in catalogues of fruit trees called Columbia superb. A large free-stone peach of uncommon excellence. The skin yellow, covered with stripes of red, giving it a singular and handsome appearance. It begins to ripen about the time the Oldmixons are about half gone. This peach is too much disposed to rot about the time of ripening to be cultivated on a large scale, but, as yet, I have been compelled to retain it, but hope yet to get a more profitable one to supply its place. One tree of this kind, in a garden or yard, is desirable on account of its excellent and beautiful appearance.

Common Heath.—This, like the Oldmixon cling-stone, is one of the most valuable peaches of our country; the color white, and the form oblong. It ripens in the fall, and is considered the finest to dry, or to preserve in sugar or in brandy.

A few years past, I had 300 bundles of peach stones put up and distributed gratuitously through this and the adjoining counties. Each bundle contained twenty-five stones of the six varieties just described.

Grapes.—I have had about thirty varieties under cultivation, of the native and foreign varieties that have been most highly recommended by the best writers of our country on the vine. The five following varieties seem most generally recommended, notwithstanding they are objectionable in many respects, the last three of which I have only recently brought under cultivation—Isabella, Catawba, Herbemont's Georgia, Hyde's Eliza, and Lenoir.

Isabella.—The fruit is of a dark purple, of a large size, and oval form, with a pulp; supposed to be the most productive grape ever known in our country. It is supposed to be a native of South Carolina. I have had this variety in my garden for about twenty years, and for a number of years I was greatly pleased with it; but for some years this grape has been nearly destroyed by the mildew, throughout our country, with the exception of our large towns, and even in them it is said now to suffer much from the mildew.

Catawba.—This is a large grape, of a lilac or bluish color, covered with a beautiful bloom, which gives to it a bluish-purple appearance. The bunches are large and uncommonly beautiful. The foliage and berries resemble the red Bland (a native, erroneously called blue English) more than any variety that I have had under cultivation. As a table grape it is only tolerable; but is said to be one of our finest wine grapes. This variety I have had in my garden as long as I have had the Isabella. It is more subject to rot than formerly; but not as much so as the Isabella. It is supposed to be a native of Maryland.

Herbemont's Georgia.—The name of this variety has been recently changed by Mr. Prince, of New York, from Herbemont's Madeira, under the impression it is a native grape of Georgia, and is now so classed in his catalogue of native grapes. Mr. Herbemont and others who have written much in favor of this grape state it is rather too much subject to rot in wet seasons; but, notwithstanding, its cultivation is highly recommended, and it is now one of the most popular grapes of our country. Mr. Prince, in his Treatise on the Vine, says, "This is an excellent grape, either for the table or for wine; the latter has been sold in South Carolina, for two dollars per gallon before it was five months old. The vine is vigorous and an abundant bearer; it is remarkable on account of the young branches having white spots on them, as if a white pellicle had been partly peeled off." Mr. McCall of Georgia, one of the most successful cultivators of the vine in our country, represents the foliage of this variety of a light green color, the juice of the grape as white, the wine becoming of an amber color, of an exquisite nut flavor; the berries round, of moderate size, and nearly black, set pretty close on the bunches, and weighing about five ounces each.

Hyde's Eliza.—This variety I have been induced to give a trial from the recommendation of Mr. Prince, who thinks it one of our first native varieties. It was but little known when Mr. Prince published his Treatise on the Vine, but from it I will make an extract: "It is a flourishing vine, the fruit is of a medium size, blue when ripe, very

sweet, and has no hard pulp." He states it to be a native of New York of recent origin, that it came up in the garden of a Mr. Hyde, and that Mr. Hyde said he called it "the Eliza, because it was reared and nurtured by a beloved daughter."

Lenoir.—The vine is represented of vigorous growth; the fruit small and black, of a superior quality to ripen early and never to rot. It is not a great bearer; but notwithstanding it should be given a fair trial. It is highly recommended. It is supposed to have originated from the seed of a foreign variety in South Carolina, upon the farm of a person whose name it bears, and is classed with foreign grapes.

I have been as particular as I could, in giving a description of the fruits recommended, so as to enable the cultivator to know them. In conclusion, to save trouble, I will state, I keep no stock for sale of any kind; and as to fruit trees and vines I have none for sale, nor have I ever sold one. Yours, respectfully,

EDMUND F. NOEL.

Edmund Ruffin, esq.,
Cor. Sec. Board of Agriculture of Virginia.

EXTRACTS FROM THE ANNIVERSARY ORATION OF THE AGRICULTURAL SOCIETY OF SOUTH CAROLINA. BY GEN. JAMES H. HAMMOND.

* * * * *

The extraordinary progress of the growth of cotton has, it is well known, occasioned a series of calculations, at various periods, from the time of the invention of the saw-gin, to prove that it must soon shoot far ahead of the consumption, and that competition would in a short time confine its culture to a few favored spots. Contrary, however, to all reasonable expectation, consumption has advanced with the same wonderful pace as production; and relying on the frequent failure of past predictions, many are even yet sanguine that it will continue to do so for a long period to come. I very much fear that they are at last mistaken—that what has been prophecy for such a time, is shortly to be fact; and that the present depression of the cotton market is neither accidental nor temporary, but the result of natural causes, and likely to be permanent.

The rapid increase of consumption has been owing to causes which can be explained, and to which limits may be assigned. A spirit of improvement in machinery for manufacturing it had sprung up in England, some twenty years before cotton began to be cultivated in this country. The hand-frame, cylinder cards, woof and warp machine, spinning jenney, and power loom, followed each other in quick succession, and Watt soon taught the whole to move by steam. The quality of goods was in consequence very much improved, and prices also reduced, so as to recommend them at once to all classes of consumers. The raw material then furnished, as might be supposed, fell far short of the augmented demand, and production was in turn vastly stimulated. The supply increased from America with great rapidity after Whitney's gin came into general use, but new inventions in machinery continued, and as even the home market had not yet been overflowed, and the demand still kept ahead of it, until the general pacification of Europe and the world opened fresh markets to this new style of goods, which could never apparently be stocked. Peace, also, made money abundant. New and immense investments were made in manufactories, and cotton mills arose all over England. It was of no small consequence to the result that England was the seat of this great manufacturing revolution. Her incalculable wealth, her great naval, superiority, and her vast territorial possessions, scattered over every quarter of the globe, gave her the command of a commerce unknown before in the annals of the world. And during a period of profound peace, longer than mankind have enjoyed since the death of the elder Antonine—and happily not yet terminated—this great nation has devoted herself to almost the sole purpose of opening new markets and filling them with cotton goods. To all these circumstances is owing the rapid stride of consumption, which has thus far out-stripped all calculation. But these causes have run their cycle; their utmost effects have been fully felt; all the markets now accessible to cotton manufactures are kept not only stocked but glutted; and although peace should continue and improvements in machinery go on, and the power of England still remain unbroken, none of which, to say the least, are certain, it is impossible for consumption to increase in any thing like the ratio it has hitherto done.

That it will increase to some extent, in every given series of years, is perhaps certain. I believe that cotton goods must undoubtedly drive linen from the almost entire monopoly which it yet enjoys in the domestic uses of the continent; that they have, sooner or later, to clothe the naked barbarians of Africa, as well as the silk-robed myriads of the Chinese empire: to ascend the Euphrates; to break more effectually through the barriers of the Bosphorus, and penetrate to all the nations of the Black Sea, the Volga and the Obe; while every birth in a large portion of the old world, and in the remotest civilized corner of the new, creates a fresh demand. But all this must be the work of time. Popular prejudices must be broken down; the policy and the agriculture of nations now devoted to growing rival commodities must be revolutionized, and manufactures must spring up and gain the ascendency where poverty and ignorance and despotism now flourish. Years, perhaps centuries, must elapse before all this can be accomplished; and peace and commerce must, for all the time, hold the world subject to their benignant influence.

It might be thought that the great increase in the sales of raw cotton during the last year (1840) argues an equal increase of consumption. But it must be remembered that the sales of 1838 were nearly equal to those of the last: that this year they have again fallen off to a fearful degree, receding to a point below those of 1839, and not much in advance of those of 1837, and that in spite of the greatest falling off in the crop ever known in one year, there has been an actual increase of the surplus on hand in Liverpool and Havre. The large sales of the last year were in fact owing to the great fall of prices, and the reduced sales of this year, to the trifling increase of them in the early part of the season, thus showing, that in the present state of the markets,

the smallest advance instantly checks consumption, which would not be the case, if the supply had not, to say the least, fully reached the limits of the immediate demand. The disastrous condition of the manufacturers during the present year, proves also, that the purchases of the last, even by the trade, were speculative, and did not indicate the true ratio of consumption. Indeed it is now generally conceded, that ever since 1834, notwithstanding the great appearance of manufacturing prosperity, more goods have been turned off than were required for consumption, and have accumulated all over the world, to an extent not so easily perceived, but not less fatal in effect than the accumulation of the raw material in the great markets of England and France.

But while consumption is thus fluctuating—giving the clearest evidence that it has approached a point beyond which it cannot advance, except with the slow march of time and the mighty changes to which I have alluded, production is not only going forward with gigantic step, but yearly developing a capacity which proves that it has yet scarcely passed its infancy, and has been creeping lazily along, compared with what it can do. If we are to believe the English, the experiment of growing improved cotton in their Indian possessions, under the direction of Americans—from our seed, and prepared with our gins, is likely to succeed. Already has some of the new made cotton been sold in Liverpool at a price higher than that of our best New Orlean's brands. I do not, however, feel very deep apprehensions from this quarter. The sample sent was probably most of it from the little Isle of Bourbon, where the finest Sea Island cotton, next to our own, is known to grow. With a soil impoverished by 2000 years or more of cultivation; with a climate in which it rains continually for half the year, and for the remainder of it never rains, so that during one period cotton will not grow at all, and during the other must depend on dews and laborious irrigation; almost without animal power; with an idle and feeble race of laborers; paralyzed by absurd social forms; and subjected to the most unprofitable as well as the most wretched system of slavery; with all these drawbacks, I cannot believe that India will be able to compete with us. It is idle to talk of her doing so with other sections of our country. To Egypt—notwithstanding the temporary effect of the galvanic energies of Mehemet Ali—and to Western Asia, belong nearly all the disadvantages of India, without the benefit of English capital and English enterprise. Brazil and other parts of South America might become more formidable rivals, but their institutions are too unsettled, and their population too motley and uncivilized, if they had no other impediments, to give us serious alarm.

But the cotton growers of South Carolina need not look abroad for competition. It is much nearer home. It is our own kith and kin—the hardy and industrious and enterprising vanguard of civilization—that have levelled the gigantic forests of the south and southwest, and furrowed the rich bottoms through which pour the tributaries of the Gulf of Mexico, from the Suwanee to the Sabine, and that have but recently rescued from a slothful race the fertile empire stretching beyond the Sabine to the Rio Grande—who are destined at no distant day, to supply the foreign markets of the world with this inestimable staple. They have just overcome all the incipient difficulties of the enterprise, and are now prepared to put forth, on the finest soil and in the most favorable climate of the earth, an energy which must inevitably crush all serious competition.

A few facts will show their progress and our own. From 1789 to 1811, the production of cotton in the United States had increased from nothing to 90 millions of pounds, of which but 2 millions were grown in the gulf states, not counting Georgia and Tennessee among them. By 1826, these states had risen by slow degrees to 135 millions in a crop of 368. In 1834, the whole crop had increased to 457 millions, of which they produced 252 millions, or rather more than half. And in 1839, when the crop amounted to 830 millions, the same states grew 600 millions, having in the last five years doubled their production and made 100 millions more, while the rest of the cotton growing states in the aggregate had actually, for thirteen years previous, made no increase at all. The world is accustomed, especially of late, to speak with astonishment of the unparalleled progress of the growth of cotton in this country. Yet for fifteen years now the whole of that progress has been made in the gulf states. Notwithstanding the high prices, we have been stationary. Is not this a startling fact? It seems to me of itself to settle the question, and to leave no doubt that these states, having now but fairly prepared themselves for it, so soon as the check on consumption shall place in strict competition all the cotton growers of the world, and reduce prices to their lowest point, the cultivation of this staple must be confined almost entirely to these fertile regions.

Now, I believe, prices have already reached, if indeed they have not gone below, the lowest point at which we can profitably grow cotton in this state. The average amount of cotton made in South Carolina, and I may include a large part of Georgia also, does not exceed 1200 lbs. per hand. The average expenses per hand cannot be less than $35. When every thing is taken into account for which money is paid or labor abstracted from the field to make, I doubt whether the most judicious planter is able to reduce them lower. If, then, cotton sells at an average of 10 cents net, on the plantation, to do which it must bring in the seaports 11 or 12 according to the distance of transportation, the clear profits for each hand in these states will be $85. And this includes the rent of land. If cotton sells at 8 cents net, on the plantation, the clear profit, rent included, will be only $61. If this estimate be correct, it will be seen at once that cotton cannot be profitably grown here at 8 cents per lb. Yet this is at least as much as we shall realize for the present crop, and more, I believe, than we can safely anticipate hereafter.

If any one doubts the permanency or abundance of the future supply from other quarters at 8 cents per lb. or even less, let him look a moment at the profits of the planters in the gulf states to which I have alluded. The vast land speculations incident to new and fertile countries, and the fact that every thing has been conducted there on the credit system, have, it is true, involved those states in great embarrassment. But this does not affect the productive capacity of the soil. The average crop per hand there cannot be

rated at less than 2000 lbs. The expenses per hand I will estimate at $40, although when compelled to be economical, I see no reason why they should exceed our own. At 10 cents net, for his cotton, the gulf planter will make $160, clear, against $85 at the same prices here, and at 8 cents, $120 against $61; which shows that, at prices ruinous to us, he will realize a handsome interest on his investment. But while I have estimated our production fully as high as truth will permit, I am satisfied I have underrated that of some of these states, perhaps all. On their best lands 300 lbs. per hand is not at all an extraordinary crop, and more is often made. The planters themselves, though great advocates of short crops at certain seasons of the year, would scarcely be willing to estimate their average crops at less than 2500 lbs. At these rates of production, and even 6 cents a pound net, they will make the very fair profit of $110 to 140 per hand; and unless cotton is for ever to baffle all the laws of trade, it is certain that prices must ere long range about and possibly below that poin'.

A result so fatal to us could only be arrested by the want of sufficient land or labor in these fruitful countries. But of this there is no prospect. Both may be already found or soon placed there in ample abundance, to supply not only the whole quota furnished by the United States, but all that is now furnished by every cotton growing region, for the foreign markets of the world. A slight examination will show the fact conclusively. The crop of the world for 1839, the last of which I have seen a full return, and the largest perhaps ever grown, supplied the markets of the United States and Europe with a little less than 1000 millions of pounds. At the rate of 250 lbs. to the acre, it would require but 4 millions of acres to grow it all. The four states bordering on the gulf—Louisiana, Mississippi, Alabama and Florida—not to include that almost equally fertile section of Georgia between the Flint and Chattahoochie rivers—contain 130 millions of acres. If then only one acre can be found in 32 capable of producing 250 lbs. they alone can supply the present demand of all the foreign markets of the world, and of our own also. It is difficult to compute the entire crop of the whole world, including that portion which is consumed at home in other countries than our own, as well as that which goes abroad, but according to the most extravagant estimate which has been made—excepting however the very veracious returns of our late census takers—it cannot exceed 1500 millions of lbs. At the rate per acre mentioned, it would require but 6 millions of acres, or one in 21 of those contained in these states, to yield the whole amount, and supply the entire demand not only of the foreign markets, but of the whole human family at the present moment.

In this estimate I have said nothing of the magnificent wilderness which joins us on our south-western border. Texas alone contains 150 millions acres. The climate has not been fairly tested, and like that of other regions approaching the tropics, its vicissitudes may prove too great for complete success in the cultivation of cotton. As yet, however, those best acquainted with it regard it as the most favorable of all others, while a large proportion of its soil is undoubtedly as fertile as any which has ever yielded its fruits to the hand of man. Already it is swarming with the adventurous offspring of the great Anglo-Saxon family, and offering the most formidable competition to even the bountiful bottoms of the Mississippi and Red River. When sufficient labor shall have found its way thither, as it is now rapidly doing, no one can venture to assign a limit to either the extent or cheapness of its production of cotton. There is little question, however, that out of the 280 millions of acres, embraced in this country and our own gulf states, land enough will be found in considerable bodies of such quality as to grow, at 6 cents a pound, or less, cotton sufficient to supply the progressive demand of mankind in all time to come. For were they at this moment to be civilized by some supernatural influence, with every avenue of commerce thrown wide open, and every article competing with it drawn from the market to the full extent that probably they ever can be, the 800 millions who inhabit all the earth would scarcely require more; 8,000 millions of pounds. This they might produce on 30 millions of acres, or 1 acre in 9. And when it is remembered that one half of France and one third of England, barren as they were by nature, are now in actual tillage, it cannot be extravagant to suppose one ninth of these prolific soils well adapted to the growth of cotton.

Nor will there be any deficiency of laborers. White labor, it is true, can be made available only to a very limited extent. But there are in the United States and Texas upwards of two millions and a half of slaves, 1,500,000 of whom may be rated as efficient hands. Those who grow cotton make their own provisions, or can do it. To meet the remaining agricultural and domestic, as well as all other demands for slave labor, will scarcely require more than half these hands. So that the other half, or 750,000, may be employed in cotton culture. These, at even 2000 lbs. each, will produce 1500 millions of pounds, which is precisely the amount at which I have computed the crop of the whole world. But the present demand of all the foreign markets and our own can be supplied by 500,000 properly located; and there is little question that such a location will be speedily effected. This done, we shall have an actual surplus of slave labor on our hands.

If, then, the consumption of short staple cotton has reached such a point that the least advance on the present low prices immediately checks it, and one at which it seems scarcely possible, at any prices, to maintain it, if at the same time the production of this kind of cotton is increasing every where over the world, and especially in the countries bordering on the Gulf of Mexico, both in and out of the United States, who, though latest to begin its culture, possess such advantages of soil and climate as to have already far outrun all competition, and, having conquered most of the difficulties incident to new countries and new enterprises, do now furnish six-tenths of the demand of both the American and European markets, and are capable of supplying, almost immediately, the whole, at such prices as are utterly ruinous to us, if all these things be true, as I have endeavored to show they are, the conclusion is irresistible, that the planters of South Carolina will be speedily compelled almost if not altogether to abandon its longer cultivation."

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"Deprived of cotton as our main crop, we shall be compelled to resort to every variety of production which our soil and climate affords, to make out a crop which may be profitably cultivated. Among them I have no doubt that cotton will always hold a place to some, though probably a small, extent. I have estimated the average production of the best cotton regions at 250 lbs. per acre. And although they have much that will do better, I think I may safely say, that land which will produce 300 lbs. need not fear any competition. We have no bodies of such land in our state. But here and there spots may be found, and by judicious management more can be made to do it. So that every planter who will be content to lessen materially his cotton crop, and commence at once to manure highly all he plants, may yet be enabled to grow some of his favorite article. For the bulk of his crop, however, he must adopt some of the substitutes I shall enumerate.

In all that I have heretofore said, I have spoken of short staple cotton exclusively. It is well known, however, that South Carolina is the largest producer of the best Sea Island cotton. In its finest qualities we have, I believe, as yet no rival. How far this crop may be profitably extended is uncertain. The consumption of it has fluctuated around the same point for the last thirty years, and we might infer had reached its maximum. But by a judicious system of culture, there is reason to believe that the inferior qualities—the Maines and Santees—may be grown so cheaply as to drive out of competition the Egyptian and better sorts of Brazilian which now rival them, and thus secure a larger market for ourselves. Our planters on the sea-coast already put in little enough to the hand, and are alive to the advantages of manuring. Let me recommend to their earnest consideration a much more extensive use of that implement which has wrought such a revolution in short staple culture within the last 10 years. I mean the plough. Horse power is in planting what machinery is in manufacturing. And it not only saves labor, but does better work and assists to preserve and renovate the land. Cato said—so long ago as his day—that "the best culture of land was good ploughing: the next best, ploughing in the ordinary way, and the next best"—but after these, "laying on manure." I commend his maxims to our Sea Island planters, and believe that by the adoption of them they will soon absorb a portion of the labor which will be thrown out of the short staple crop.

The culture of rice upon sea-board has stood the test of time and competition, and we may safely regard it as a great and valuable staple, of which no contingency is likely ever to deprive our state. The demand is steadily increasing, and offers a fair reward to those who will embark in its production. Although we grow three-fourths of the crop of the United States, only a small part of the state adapted to it has yet been prepared for cultivation. Vast inland swamps well suited for it, yet frown in barren gloom every where below the ridge, while many of our up country bottoms, which are destined at some future day to groan beneath its harvest, are now idle wastes, consigned to flags and rushes. The necessity which shall drive us to drain these grand reservoirs of disease and death, will one day be hailed as an inestimable blessing. We cannot too soon turn our attention to it, and instead of drawing our supplies of rice from the sea-board, we of the up-country may at no distant day send our tributes to unite with theirs in supplying the north, and western Europe, where this luxury is fast becoming a necessary of life."

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"The innumerable streams which intersect the state, and the gradual fall towards the ocean of even the flattest parts of the low country, afford great advantages for draining, while nature has been extremely bountiful to us in materials for manure. In many parts of the state marl has been found in abundance, and at convenient points for water transportation: and no doubt it will yet be found where it is not thought of now. In other parts limestone exists to an unknown extent; and in others again salt-marsh and oyster-banks abound. Almost every where upon our rivers, creeks, and branches, and in our swamps, we have rich alluvial deposites, a portion of which may be well spared to recruit the exhausted soil near: and our forests furnish a boundless supply of leaves and straw, which in various ways may be converted into valuable compost. Possessed with these resources, and all the usual ones incident to farm yards, whenever we resolve to set seriously about it, I question whether it will be found near so tedious or expensive to reclaim our waste and renovate our worn out lands, as is now generally supposed. But this interesting topic alone would require all the time allotted to this occasion, and I must therefore pass from it to continue my enumeration of the substitutes to which we may resort when we can no longer depend upon our cotton crops.

"Although we now purchase from other states, probably one half the flour we consume, there is hardly any part of this state in which wheat may not be grown. Fair crops may now be occasionally seen within 40 miles of the sea-coast, perhaps nearer; and few soils or climates are better adapted to it than the upper parts of South Carolina. The flour made there, when skilfully managed, is not in the least inferior to the best that we receive from Virginia or the Lakes; and it only requires an impulse, such as the loss of the cotton crop will give, to convert our state into an exporter instead of importer of the article. The same may be said of every other kind of grain. We obtain large supplies of oats, rye, barley, and even Indian corn, from other states, when few or no states can grow them in greater abundance than our own. I do not allude to the fact to condemn the practice in the wholesale, as it is now becoming customary to do. The planter is but little more capable of raising to advantage every thing within himself than other persons, and if he is cultivating other valuable crops which will enable him on a fair calculation to purchase these things cheaper than we can now grow them, he is just as correct in doing so as the merchant is in buying his hat or the tailor his shoes, instead of making them in their own families. But when the more valuable crops fail, and the means of purchasing are taken from us, we shall be driven to produce provisions of all kinds, and I feel assured that we will soon find that we can do it as abundantly and cheaply as it can be done in any other place. The prospect of a foreign market is not very flattering, it is

true, but when England repeals her corn laws, which in a few years she will be forced to do, we can at least take our chances with the rest of the world for her market, and with some advantages on our side, if no unjust tariff shall prevent our receiving in payment such of her manufactures as we may not make at home.

But we might convert our surplus corn and grain into live stock as well as any people in the world, and thus keep at home immense sums which are annually drawn from us in exchange for horses, mules, cattle, hogs, sheep, and even poultry. Our climate has not been found too warm for any species of domestic animal. English cattle and sheep, as well as English horses, flourish even on our sea-board; and our mild winters enable us to keep all kinds of stock at comparatively little expense for either food or shelter. Our swamps are covered with natural and nutritious evergreens; most artificial grasses have been found to succeed; while among our own diversified productions, we have substitutes which render them scarcely necessary. Carrots, beets and turnips all do well. Pindars and sweet-potatoes, more valuable perhaps for stock than these, are peculiarly our products. With these two articles, the luxuriant cow-pea, and the common grains, we can, for 9 months in the year, furnish at a cheap rate, the richest and most abundant pasturage: and what country can do more? Indeed, in raising hogs, could we find a foreign market, or had we large cities or numerous factories among us to afford non-producing consumers, we could do a business not at all less profitable than growing cotton at 12 1-2 cents a pound. With tolerable pasturage, a hog weighing 200 lbs. net may be reared and fattened on 8 bushels of corn. On average land, 300 bushels to each hand and horse would not be more than a fair crop—100 bushels will feed the hand and horse, leaving 200 bushels surplus. With this 25 hogs, weighing 5000 lbs. net, may be raised. At 4 cents per lb. for this pork, or 6 cents when converted into bacon, the gross income per hand will be $200; while 1200 of cotton at 12 1-2 cents, will bring only $150 gross; thus enabling us to make a very liberal allowance for the trouble of attending to the stock and any errors there may be in the calculation. That we should, under these circumstances, ever purchase meat from other states, proves, I think, that there has been some want both of reflection and experiment. Yet, for this article, and other kinds of provisions, and for mules and horses, it is pretty certain that we send away annually in the aggregate the immense sum of $2,000,000 or more.

Tobacco and indigo our state produced largely at one time. They have been superseded by cotton, though still grown, I believe, in small quantities, and chiefly for domestic use. In some sections their culture can, and doubtless will, be revived with profit. The discoveries of marl and limestone will afford greater facilities for the manufacture of indigo than heretofore possessed. Sugar, of which we are now said to make 30 000 lbs. per annum, may be made here as cheaply, perhaps, as we can buy it, when the loss of cotton shall stop our supply of money from abroad. Unless, indeed, the duty be repealed, so that we can get it at half the present price, and probably in exchange for our provisions and other products. At all events its culture is practicable here; and where it will not granulate, an excellent and valuable syrup may be extracted from the cane; and that has been grown at 200 miles distance from the coast. Should it turn out that there is any ground for a statement which I have lately seen in a respectable agricultural journal, and apparently from a respectable source, that sugar has been made from corn stalks at the rate of 1000 lbs. to the acre, but a short period can elapse before every farmer in the country will regularly manufacture all he consumes.

Flax and hemp do well in the up-country. Castor and bene oil of the very best quality have been expressed in different parts of the state, and olive oil also may be made, for we know that the olive tree can be reared here. Tar, pitch and turpentine, considered so important elsewhere, we can produce to almost any extent; while with timber and lumber of several of the most valuable kinds, and with staves and shingles, we can for ages supply all the markets within reach, and do now furnish large quantities at excellent profits.

The cultivation of the vine has heretofore attracted some attention, but the attempt to make wine has generally been regarded as having failed. I have little doubt the failure has been owing in a great degree to the recent planting of our vineyards. It is well known in wine countries, that no vineyard is considered of much value until it has borne fruit for at least 20 years. Yet we have been disheartened because ours have not arrived at maturity in 5 or 6. A short and intense summer, or something in location equivalent to it, seems to be required for the perfection of the grape, and it is possible that being so far south, we may not be able to make the best qualities, at least of what are called white wines; though of this we should not despair until our mountain districts have been fairly tried. That we may, with due care and in due time, produce abundantly, in every section of the state, the light wines of Italy, and perhaps some of those of the south of France which are so highly prized, there is every reason to believe.

The experiments which have been made in silk culture leave no doubt whatever of our complete success in that. In fact, American silk is said, on very good authority, to be better than that made in any part of the old world. And in no part of America can it be better made than here. As a proof of this, an enterprising lady of one of our upper districts, obtained this year from the New York Institute, the first premium for the best silk grown and wove in the United States, against competition from almost every section of the union. It is stated by some of our historians, that so far back as 1759, 10,000 lbs. of raw silk was exported from South Carolina. Whether this be true or not, we all know that none of our soils are so poor, and no portion of our state so cold, as not to grow the mulberry in its utmost perfection. It is true that the enemies of the worm have been found very numerous, and its disease fatal; but it is ascertained that in all silk countries at least one half of them, from some cause or other, perish before spinning. If we were properly prepared to rear them, the mortality here would not, I am confident, be so great as that. And if, as it is supposed, nealy all that die fall victims of a disease called *muscardine*, and a remedy for that has

been discovered, as recently announced, in the use of lime, it is perfectly certain that in growing silk, we may very soon compete with, and probably excel, any other people. If by means of ice the worm can surely be retarded until the most critical periods of our other crops have passed, a crop of silk may be made which would be almost clear gain to the planter.

I have enumerated some of the most prominent of our productions to which we may resort when no longer able to grow to advantage the great staple, which for the last 40 years has absorbed all our husbandry. But why, when this event is made manifest, shall we confine ourselves strictly to agricultural pursuits, possessing, as we do, so many other resources, inviting and rewarding as amply here as elsewhere enterprise and industry? An all bountiful providence has blessed our favored region with mineral wealth of incalculable value. In many places within our state vast quantities of iron ore have long been known to exist, and within the last few years much enterprise has been exhibited and heavy expenses incurred to turn it to account. Already forges, furnaces, bloomeries and rolling mills, have been put in operation, and with every prospect of complete success. No coal has yet been found in the vicinity of any of these beds of ore. That is a discovery, however, which the geological character of the country gives ground to hope may be the reward of future research, while for a long time to come the immense forests near at hand will render it unnecessary. The consumption of iron of all kinds, exclusive of cutlery, in South Carolina, must, if she consume in equal proportion with the other states, exceed $2,000,000 per annum; and this sum kept among us would not only enrich the explorers of this hidden treasure, but contribute through a thousand channels to enrich the state. Veins of gold have also been opened, and some of our mines have proved more profitable, I am well informed, than any in the union—perhaps in the world. Quarries of marble, too, have been discovered, and beautiful specimens extracted: and granite forms the basis of one third of our state. Salt has been manufactured also on our sea coast, and there it no reason that it should not be made to any extent required.

GLEANINGS.

For the Farmers' Register.

King William county, May 18, 1842.

Peas may be successfully grown among corn, especially in light land, planted in every row, between every other hill, where the distance of the corn is 5½ by 3 feet; but much of the profit will be lost, if the old method of gathering by hand-picking be pursued. If planted before the 1st of June, after throwing the first furrow to the corn, the crop will have so nearly ripened by the middle of September, that the vines may be pulled up and hung on the stalks for a few days, when all the peas will be dried, (the few unripe ones dried green not injuring the sale.) Then they may be hauled to the barn-yard early in the morning, and after a few hours' sun, trod out with very little trouble. This method I have adopted from a neighbor, the profit of whose pea-crop for several successive years has exceeded his wheat. There were shipped from our county town, Aylett's, the past season, 10,000 bushels, at the average price of $1; and though my crop raised among the corn was but a very small part of this quantity, yet, at $1.12½ per bushel, I felt it, as a thrifty housewife with her good floor cloth of refuse rags, as so much "clear gain."

On the corn crop and its culture.—While I am satisfied by experiment that we have several kinds of yellow corn more productive on thin lands than the Maryland twin, I am not prepared to pronounce on the best for all lands. Our mode of culture I think about the best. After preparing the land well with plough and harrow on single beds, the grain is covered, and as soon as well up, with the single plough a list is thrown into the water furrow, leaving a space sufficient for a four-tooth cultivator, which leaves very little work for the hoe hands, except thinning the corn. We next throw a furrow on each side to the corn, lapping the dirt very moderately, and now the peas (small black-eyed) are planted; another furrow on each side over the whole field, and lastly the middles thrown out, which, on account of the list first thrown back, leaves a small water-furrow, and the land sufficiently level. A very slight weeding completes all necessary labor on that crop; for I have gleaned the fact that working corn, with almost any implement, after it tassels, is injurious rather than beneficial, while late working, in ordinary land, so effectually prevents the springing of grass, that there is nothing to be returned for the benefit of the succeeding small grain. Suggesting this idea to an observing farmer, who was in the practice of working his land too early and too late, a cold livery soil, readily *liquidizing* in winter, (excuse me for coining the word, which will, however, be very intelligible to the unfortunate owners of such lands,) he confirmed its correctness, by informing me that in a severe drought, fearing to break the roots on both sides of his corn, he passed his cultivators in a part of his field along every other row. The corn was no better than where they were not used; but in the succeeding spring, the wheat appeared a high bed and a low one, discoverable at a considerable distance. But I learned with surprise from my friend Braxton, not long since, that on Pamunkey it is a conceded point that wheat will not succeed after crab grass, which I believe almost invariably follows corn of the same year. We on Mattaponi have opposite experience.

Roots.—"The difference in the value of our roots fed raw or cooked" is so inconsiderable, except the Irish potato, or as a condiment for less savory food, that I doubt if the gain is equivalent to the cost of boiler, fuel and attendance. Grain is more digestible when cooked, but meal or fine hominy I think more valuable; for I have often observed whole grains of corn, although boiled, pass undigested even from ruminating animals.

Sassafras.—Being much annoyed at a former residence by sassafras bushes, I was informed by my old friend, the late Mr. Henry (Speaker) Robinson of Hanover, suffering with the like pest, that by leaving the original sassafras trees in clearing land, or turning out young ones in old land, the bushes would disappear. I accordingly had young trees trimmed and suffered to grow at

70 or 80 yards' distance apart. They have now acquired size to shade the cattle, but I have never seen a more abundant crop of the bushes than at present. I have tried grazing them at various seasons, deep summer grubbing, and cow-pens on spots without success; and believe there is but one infallible and permanent antidote, and this is what we in lower Virginia may well call the *grand restorative* of exhausted land, fire wood and rail timber, the old-field pine. On a farm adjoining me, as much infested with sassafras a few years since as perhaps any I ever saw, it is over a large surface entirely supplanted by the pine.

I will close these gleanings with a few observations on the subject of *gelding animals*. The operation should be done in warm weather, and exposure to wet or even damp atmosphere guarded against for a week at least. Without this precaution many a fine animal has fallen victim to tetanus or locked jaw. But the particular practice which I wish to suggest to my brother farmers is to substitute for the barbarous custom of searing, and the awkward one of clamping, the simple and safe one of tying the blood vessels, not with twine, however, but with animal ligatures, following the example of the surgeons: narrow strips of sheepskin dressed without tan, and rolled as the shoemakers do, will answer very well. The ends may be cut off short after tying, and in twenty-four hours all danger of bleeding will be over. Washing with salt water will be fully sufficient to excite suppuration, and anointing all the surrounding parts with elder leaves stewed in lard will prevent all inconvenience from flies. To all these items I would, as old Father Wesley, subscribe "Tried." W. G.

BENEFICIAL EFFECTS OF THE GREEN-SAND EARTH OF JAMES RIVER, RECENTLY OBSERVED.

By the Editor.

As it has fallen to my lot to make and to report much the greater number (indeed nearly all) of the experiments and applications of green-sand *alone*, as manure, in Virginia, and as the greater proportion of my applications have been profitless, or without effect, and the general results discouraging to the practice—notwithstanding some remarkable exceptions of powerful effects, produced by this earth—it is the more especially incumbent on me to report, without delay, some more recent trials and their very different results. The difference of results, with the supposed difference of circumstances, also, seems to throw some light, though feeble and uncertain as yet, on the heretofore dark and inexplicable differences of operation of what seemed to be precisely the same agent.

The new facts learned of the effects of the Pamunkey green-sand and green-sand marl, and reported in vol. 8 of the Farmers' Register, induced me to request of my son, who is co-proprietor and sole director of the Coggins Point farm, to resume the use of green-sand for experiment. His first experiment, stated below, was before reported (3d) p. 86, vol. x. Before its having any effect was despaired of, he saw at Evergreen the beneficial effects of an application, which he described in a communication published at page 645, vol. ix., and which experiment was commented on subsequently at page 135 of the current volume. This fact induced the larger application of last November. The green-sand earth used was dug from under the Coggins Point beach, which is all formed of it, after removing a few inches of sand, gravel or pebbles. The darkest was chosen, such being deemed the richest in green-sand. No gypsum was perceptible, nor any other known fertilizing ingredient, except the green-sand itself, and a few small fragments of shells, which would scarcely amount to as much as one per cent. of carbonate of lime in the whole mass.

Experiment 1.—In the spring of 1841, as much earth was dug, of the part first reached, as covered 8 acres, at 40 bushels to the acre. The land was a level loam, of good quality, then in wheat and clover. Two wide beds, in different parts of the ground, were left without being dressed, for comparison. The spreading carefully made to the marked outlines of these omitted spaces.

During all 1841, and up to 8th of May 1842, when the stock of cattle were first turned on, and soon grazed the whole bare, there had not been produced the least visible benefit or effect by the dressing. N. B. On this same land, the first observed very great benefits from green-sand were produced in 1827-9, and which did not remain but a few years, (See Exper. xxiii, p. 121, vol. ix., Farmers' Register.)

Exp. 2.—In December, 1842—Enough earth was dug (adjoining and precisely alike in appearance to the last) to cover 40 acres more, at same rate, (40 bushels,) on clover sown in the spring or winter previous. Of this, the first used, and taken from the top or most exposed part of the bed, as before, has shown no effect up to May 21st, when the clover had reached full growth, and mowing for hay had been proceeding some days. After the dressing had covered some 6 or 8 acres, a marked interval was omitted; and another one after 5 or 6 more acres had been covered. The dressed clover, on each side of the first of these omitted spaces, showed a very slight benefit in May, and at the second interval greater benefit; but not regularly, and not enough altogether to repay the expenses of the application.

Exp. 3. The same rate of dressing as above stated was continued, and though no more marked spaces were omitted to compare results, there could be no doubt of there being very great, though irregular effects produced on the last 10 or 15 acres dressed. This was most apparent at the broken lines, where the work had been interrupted; and as it had not been designed as the conclusion, the out-line of the spreading was very crooked and irregular. The difference in product was every where most marked, and the dressed clover a vigorous growth, of rich deep green color, while the clover immediately adjoining, and not dressed, was comparatively yellow and mean. Several small detached spots of luxuriant clover were seen outside of the general dressing, and surrounded by the mean growth; and upon looking for the cause of such superiority, in each case a lump of green-sand earth was found in the middle of the rank spot, which had been thrown beyond the general spreading.

If both these applications had not extended beyond 15 acres, the results would have indicated

that the manure was not worth any thing. In the next 10 acres, there was not enough benefit to invite more extended applications. And it required to see the last 10 of the 48 acres, to be sure that the effect was indeed very great, and profitable for the outlay, even if the direct benefit shall cease with this one crop of clover.

The inference drawn from the great difference of result, and which causes to be awakened renewed hopes of future success, is that the upper part of the earth, from being long exposed to air and water, has lost its fertilizing ingredient or power, and that by digging deeper to obtain the manure, as profitable effects may generally be produced on clover, if on marled or other suitable soils. The first digging, for so small a quantity wanted, was necessarily all shallow. And of the second, the first 10 or 12 acres were probably dressed with earth dug from mostly within a foot of the surface. The space dug was large enough to allow the carts to enter, and sloped outward for their easy ascent when loaded. Of course, the latter part of the work must have been generally from the deepest dug earth, though not regularly so. The deepest part was about 3½ or 4 feet in the green-sand earth. Other and more extensive applications will be made during this year, and some accurate experiments on a smaller scale, which will at least serve to show whether this new ground for hope be well founded, or as deceptious as others have before been found.

As little of the whole space dressed as really showed much and certain benefit from the application, and irregular and variable as were the actual effects, still there was enough benefit to furnish, in spots, some 12 or 14 acres of fine clover for mowing; some of it as rank and heavy as could well stand. And without the use of the green-sand, judging from the appearances on as good land not so dressed, there would have been very little, if any clover worth the mowing. Of this general fact, the occupant of the farm is convinced, though he was incredulous, and hopeless of any valuable result until very recently.

Coggins Point, May 21st, 1842.

THE GROWTH OF WIRE-GRASS KEPT DOWN BY TOP-DRESSINGS OF LEAVES.

When an interesting fact, observed on Coggins Point farm, seeming to show this effect, was communicated not long since to the Farmers' Register, the writer was not aware, and we had forgotten, that a still more obvious proof of the same effect had been before observed on the same farm, and noted, by Mr. A. Nicol, when he was the manager there. The passage of the journal of the farm in which Mr. Nicol wrote down the observation when made, by accident has again fallen under our notice. It will be copied below, in the precise words of his entry in the farm journal, as written September 2, 1838.

"There is one singular result attending the application of leaves as top-dressing to wheat during the past winter, worthy of notice. In scattering the leaves, they were extended over a portion of ground thickly set with wire-grass. There is now on the leaf-covered portion of ground a very scanty portion of this pest growing; while on the ground adjoining, the growth is very dense. The line of separation is very distinctly marked, and follows all the little departures from a straight line made in scattering the leaves. The cause of this singular and unexpected result is of course uncertain—whether caused by the smothering effects of the early application of the leaves, or something in them injurious to the growth of wire-grass, has yet to be ascertained. That the first should have caused such an effect is scarcely probable. The covering of leaves was much too thin [to smother the growth,] and the fact that the remaining portion of the patch [of wire-grass] has been since thickly covered with straw without producing such an effect, renders this supposition extremely improbable. Nor do I know of any quality possessed by pine leaves that should be unfavorable to the growth of wire-grass."

This is a very interesting fact, and one which admitted of being observed with great accuracy; and it is rendered the more valuable because of the like result since observed by another witness, to whom the fact observed was also both novel and inexplicable. Whatever may be the manner of operation, the good effect may be easily obtained by means very beneficial in other respects. It seems to us clear from the facts above stated, that it was not by smothering the wire-grass that its growth was obstructed—but truly by the other supposed cause, that is, some quality of the leaves poisonous to wire-grass; and that quality we believe to be the *acid products* of pine or other leaves. Wire-grass delights in calcareous earth in a remarkable degree; and therefore the antagonist principle, or food, which is acid, must be as much injurious.

By planting Irish potatoes on the worst wire-grass turfs, (with or even without ploughing,) and covering them over thickly with pine leaves, as has been recommended in previous parts of this work, perhaps it might be found an easy mode of raising a crop, and the cheapest mode for destroying the wire-grass sod, and converting it to manure.—Ed. F. R.

CHARCOAL AS A MANURE.

From the Transactions of the New York State Agricultural Society.

There is no subject connected with farming that requires so great attention as "*manure.*" Let the land be ever so sterile and barren, it has been fully ascertained that by a judicious course of manuring it can be enriched and made productive. Let the soil be as rich and as full of succulent matter calculated for the producing and

nourishing the variety of plants necessary to be grown for the use of man and the benefit of the animal creation, a continued course of tillage, and a series of years' neglect of manuring will certainly render it barren and unproductive. Upon the state of the soil on every farm depends the living, we may say, of the farmer and his family, and carrying out the principle in its most extensive sense, upon the activity and intelligence of the farming community depends the whole interest of the entire commercial and civil community of any country. These facts are so evident to any man, who will take but a moment for reflection upon them, that it is a wonder indeed that more attention has and is not directed to this all important question, as to what are the best manures? No doubt the manures that are well calculated to produce a decided and active influence at once upon many soils would not act so readily and so permanently upon many other soils; but there are many manures that so act upon all soils; or, at best, there are many applications that may be made to almost any soil, that if they are not manures themselves, form the basis upon which the principles of other active manures may be made to produce the most astonishing effects. I have recently had my attention directed to the use of *charcoal*, by the knowledge of some facts that have been communicated in answer to my inquiries, that have induced me to devote a paper to the subject, in the hope, at least, that it will excite attention, and be productive, in the end, of great good to the community by inducing a series of experiments upon the use of charcoal as a manure, that will result in immense benefit to the farming interest.

I shall not pretend to enter into a series of reasonings upon the chemical affinities of charcoal to the soil upon which it may be applied; these matters I shall leave to those whose education and pursuits have better fitted them to ascertain these things, by enabling them to reach them by chemical analysis, which I am unable to make. I shall simply state the facts which I have observed, and those which I have learned from others, whom I have requested to look to them, together with the results that have been obtained, leaving to others to say whether the question is not of sufficient importance to lead them to try whether the results will not be equally beneficial in very many other situations.

In the neighborhood in which I live there are a great many hearths of coal pits, as they are called; places where wood has been piled, and burned into charcoal, scattered about the country. I have invariably observed, that upon these hearths, in the course of a few years, a luxurious coat of grass made its appearance, when all around in the vicinity scarcely a blade of grass could be found, and what there was found out of the coal hearth was sickly and dwarfish. This was so well known that in the heat of summer, when the pasture in other places was dried and withered by the summer drought, it was a common practice to drive the cattle to the "coalings," as they are called, sure that they would there obtain food. During the last autumn, business called me into Harford county, in Maryland. While there I was surprised at the exceedingly luxuriant growth of a crop of grain but lately seeded in a field, on Deer creek, and also at the very peculiar appearance of the soil. The soil upon which the grain was growing had a remarkably dark appearance, and appeared to be so mellow and friable as nearly to bury the foot at every step, and although it lay very level, did not appear to the touch to be so; not as the soil in the other fields around it on the same level. My attention was excited by what I saw, and I inquired if the field had not been covered with charcoal, and was told that it had been. I inquired when it was done, and was told it had been spread upon it more than *twenty years* ago!! I then asked what was the general quality of the crops raised upon it, and I was told that they were invariably fine, both as to quantity and quality. The person who lived upon the property informed me that he had repeatedly hauled the soil from that field and spread it upon the surrounding fields, and he could, for years, or in fact from the time he spread it there to the present day, always see, by the growth upon these places, exactly where he had put it!!

I had for some time past had my attention directed to the subject, but here I found it fully developed to my full satisfaction.

When I returned home, I made it the subject of conversation frequently with the farmers in our neighborhood, and from one of them I learned that when he lived in Chester county, Pa., with his father, a part of their farm became worn out and unproductive. It was abandoned for several years, and in the mean time many coal pits had been formed upon several of the old fields, by drawing the wood there to burn into coal, that had been cut in the adjoining timber lands. After some time they again put those fields under tillage, and he states that wherever a coal hearth had been left, there the crop of grain and the growth of grass was equal, if not superior, to that which grew upon any of their most productive fields. Another case of the application of charcoal I have found in this neighborhood was made by a gentleman in the iron business to his meadow, near the coal house. He had a large quantity of the coal that had become too fine to be used in the furnace; he did not know exactly what to do with it, it was in the way, and he concluded, as the easiest way to dispose of it, to haul it out and spread it upon the grass land. He spread it late in the fall, and for many years he informed me he observed the most astonishing effect produced upon his yield of grass. The quantity was nearly double, and the effect continued as long as he owned the property, which was at least ten years; so he informs me.

From what I can see of its effects, where a large quantity is left upon the ground, as for instance, in the centre of the hearth, it takes a considerable time for it to acquire a sufficient degree of moisture to penetrate to the bottom, and until it has acquired that degree of moisture nothing will grow there. Around the outer edges of circles where it is thrown upon the ground it is soon saturated with moisture, and vegetation is soon facilitated, and goes on rapidly. I should judge, from this, that when about to be applied to land the coal should be ground fine, and then thoroughly wetted and sown or spread with a lime spreader over the surface of the soil. From the circumstance of its being easily powdered or mashed up, I should suppose that the process would be very easily effect-

ed by making a floor of plank, say circular, and procuring a good sized stone, to be affixed by a shaft to an upright post, throw the coal into the circular planked way, and attach a horse to the shaft passing through the stone, and drive him round, carrying the stone, in its passage, over the coals. A very simple and easy process, precisely similar to the old fashioned way of grinding or breaking up bark, practised by the tanners, previous to the invention of the cast iron mill now in use. The cost of covering an acre would be trifling, and if it produced no other effect than that of forming a permanent vegetable basis in the soil, for lime to act upon, it appears to me it would well repay a greater amount of labor and expense than would be necessary to try it.

I have just been made acquainted with another result of the application of charcoal to arable land, that if general, from its application, will induce its use by every one who can procure it at a reasonable price: that is, wherever charcoal has been applied *rust never affects the growing crop of wheat!!* My friend who has communicated this fact to me states, that he has observed it particularly, and when the field generally has been "struck with rust," as it is called, those places where he had applied the charcoal *invariably escaped.* J. H. Hepburn.

Jersey Shore, Lycoming Co., Pa.

From the (London) Farmers' Magazine.

CAUSES OF FIRE.

Mr. J. Murray has published a letter in a Liverpool paper on the frequency, causes, and prevention of fire, which contains many facts well worthy of attentive consideration. Among other observations, he says—

"There is far too little attention paid to the locomotive engine on our railroads. The ignited coals that fall below are often blown to considerable distance, carried into the adjoining fields, and may, in contact with farming stock prove a serious evil; and I have witnessed brushwood and tufts of grass consumed by this means. A green taper, colored as it is by means of oxide of copper, when blown out, acts on an aphlogistic principle, and may continue to the end of the coil in an ignited though flameless state, and, in contact with combustible materials, may prove seriously destructive. It has set a mahogany table on fire—providentially discovered in time. Damp rags, *en masse*, may spontaneously take fire, and have consumed the premises. Linseed and other oils, but especially that of linseed, have been the fruitful sources of conflagration in cotton factories and the warehouses of merchants. Nets dipped in oil, and cast over the rafters in an outer shed, set them on fire; and a bale of cotton wool burst into a flame from linseed oil being poured upon it. Even animal matters, such as woollen, under such circumstances, come within the precincts of danger. I find that strong red fuming nitric acid will set fire to straw; and an accident of this kind once occurred to myself. The vapor of sulphuric ether, instead of being volatile, and ascending, as is generally supposed, falls to the ground like water; and accidents in the laboratory and shop of the druggist, from ignorance of this fact, are by no means unfrequent. I am personally acquainted with three distinct cases, wherein the premises were set on fire originating in this source. Specks of bull's eyes in window glass may, on the principle of burning lens, ignite inflammable substances brought within the limits of their focus; hence the curtains used in some factories may be easily ignited; thus, too, a water-bottle left in a window, may in sunshine be the means of setting premises on fire, especially in a house shut up during the absence of the family; and I have seen a silk curtain consumed to tinder by the concentrated rays of the sun, in passing through the show-bottle in the druggist's window. Spirits of turpentine will inflame if poured out in the hot sunbeam; and I am informed by the distillers of tar and turpentine that the head of the still cannot be safely removed for thirty hours after the fire has been extinguished, as an explosion might be otherwise anticipated. Lucifers, or Congreve matches are one of the fruitful sources of fires. Those that are called Dutch, containing phosphorus and having a very fœtid phosphoric smell, are exceedingly dangerous: they may ignite spontaneously at the temperature of summer heat; and it may now suffice to say that a recent conflagration has been traced to this cause. The cigar and the pipe are pre-eminent sources of modern conflagration; and I have no doubt that of the seat of the Marquis of Londonderry, and the late one of York Minster, are entirely attributable to the pipe or cigar used by the workmen engaged in repairs. It is not generally known that tobacco contains nitre, and that, like touchwood, it continues ignited for hours. Fires occuring from this cause are, I apprehend, too notorious to need specific detail. It is clear that the end of a cigar dropped among wood shavings might be fanned into a flame by a current of air; and tossed from the top of a coach into an adjoining field, and carried by the breeze into a farmer's stack-yard, hay ricks and wheat stacks may even burst into a flame. I believe many a cigar smoker is an unintentional incendiary.

"Fires in farm-yards also may originate from quick lime left in a cart under a shed, and moisture getting to it. Heat sufficient to cause combustion is developed. The spontaneous combustion of hay-ricks from the dampness of the hay, is a danger to which the negligent farmer is often exposed. In our present state of chemical knowledge it is idle to attempt to follow this phenomenon through its course, or to explain the reasons for the heat produced in fermentation. As water must be present in fermentation, it is probable that it is decomposed, and it is commonly said that the flame produced is the result of intense chemical action; but, as Dr. Thompson remarks, (System of Chem., vol. iv. p. 364)—'All the phenomena of fermentation lay for many years concealed in complete darkness, and no chemist was bold enough to hazard an attempt even to explain them. They were employed, however, and without hesitation too, in the explanation of other phenomena; as if giving to one process the name of another of which we are equally ignorant, could, in reality, add any thing to our knowledge.'"

IRON HOOPS FOR COTTON BALES.

From the South-Western Farmer.

Why so much opposition in New Orleans to this very valuable improvement in baling cotton, and why is it so?

The iron hoop possesses all the advantages of rope and many more; it is equally as cheap, as strong and as easily put around the bale, and has a great advantage over rope in the event of fire. You could not burn up a steamboat load, or a warehouse full of cotton bales, in a month iron hooped. A cotton bale never burns much, until the ropes burn in two, and the bale expands. Cotton iron hooped need not be insured down the river, nor in the city—nor need it be re-pressed in New Orleans. Many planters are now compressing their cotton to the shipping size, and in a little time it will be the general custom of the country.

Then, why shall the planters incur the great expense of a double cut at insurance—one down the river and another in the city, with a finishing touch of 75 cents per bale for compressing, when there should not exist the least necessity for such charges?

But the planters must expect the iron hoops to be violently opposed by the insurance and steam press interest in New Orleans; but they have only to persevere and act in concert to overcome all opposition.

It is said that the hoop where it presses on the bale, will rust and injure the baling cloth. Such an argument is not reasonable, as where the hoop presses on the bale is entirely water tight, and all of the rust must be on the outside of the hoop, which could be entirely prevented, by brushing the hoop with a little paint or pitch.

The hoop iron, is sold at the factories at 5 cents per lb. Now is the proper time for the planters to send on their orders for the growing crop; which can be forwarded through the merchants at Vicksburg or New Orleans—many of the factories in Pennsylvania, Ohio and Tennessee having agents in those cities. A. PLANTER.

FEEDING ON COTTON SEED.

From the South-Western Farmer.

Near Clinton, April 28th, 1842.

In your valuable number of the 8th inst., I read some suggestions from a correspondent and from yourselves, in relation to feeding on cotton seed; and as neither of you have mentioned the plan, upon which I think they can be most usefully prepared, I will give the result of my experience and my plan to the public.

I have a large kettle, which holds from 5 to 6 bushels, set upon a brick furnace, (which is less than one day's work for a mason to make.) I fill my kettle with cotton seed fresh from the gin, and then fill up the kettle with water, and boil something less than half an hour. Then empty the seed into troughs, and let my cattle and hogs to them. The milk and butter has none of that cotton-seed taste, which the green or uncooked seed give. Both cattle and hogs will keep in good order, winter and summer, on seed thus prepared; and when you are ready to fatten pork, you have only to add an equal quantity of cotton seed and corn, and boil as above. Experience has proved to me that it will fatten sooner, and be equally good as when fattened on corn alone. Your cows will give an abundance of milk all winter, when fed in this manner, with but one bushel of corn to four of cotton seed. Every one is aware of the advantage of boiling turnips, turnip greens and cabbage for the human stomach. The boiling of cotton seed is not less advantageous as food for stock. Besides, there is great economy in feeding seed thus prepared. By the usual method in feeding, there is more than double the quantity of seed wasted that are consumed by the stock.

So far as I have heard, every person who has ever tried this plan, has been well pleased with it. Very respectfully,

D. O. WILLIAMS.

Messrs. North & Jenkins.

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EDMUND RUFFIN, EDITOR AND PROPRIETOR.

REPORT TO THE STATE BOARD OF AGRICULTURE,

ON THE MOST IMPORTANT RECENT IMPROVEMENTS OF AGRICULTURE IN LOWER VIRGINIA—AND THE MOST IMPORTANT DEFECTS YET REMAINING.

By Edmund Ruffin.

The time can yet be remembered by many persons now living, when the improvement of the general or average rate of product of land by its fertilization was scarcely attempted, or even thought of, in the lower and middle regions of Virginia. The efforts to increase the amount of the products and profits of agriculture, were not wanting then, more than now. But it was by adding to the cultivated surface by new clearings of wood-land, and by thus substituting fresh and richer ground for such as was worn-out and totally worthless. The manuring was almost limited to the partial saving and use of the excrement of the live-stock; no more vegetable matter, as litter, being used, or thought worth the labor of using, than would serve to absorb and retain the animal juices. Perhaps only the more ignorant cultivators believed that vegetable matter was not manure of itself; but of the more intelligent, but few would have deemed that the doubling the ordinary small amount of litter in their farm yards and stables, would not have been of more labor than profit, even for lands the best adapted to be benefited by such manures. With very few exceptions, there was no more litter used than necessary to prevent the cattle from suffering by the wetness and filth of their pens and beds; and to serve to soak up partially the fluid matter, of which otherwise the waste was manifest. The straw of the wheat and oat crops, and the stalks of the tobacco, were necessarily brought to the barns to be separated; and, with greater or less waste, these materials were in some manner necessarily converted to manure. But the much larger quantity of corn-stalks were left in the field, to be afterwards burnt out of the way of the next ensuing crop; and still less was any other supply of coarse litter sought or desired. Even this small extent of manure-making was a great improvement on the older practice. Thomas Adams, an observant and respectable old farmer of Prince George, who died about 20 years ago, told me that he remembered the first beginning, in that county, of keeping up the work horses at night, on litter, for the purpose of increasing the manure, instead of turning them out to graze in the pastures. The practice was introduced by a new overseer on Old Town farm, then one of the "quarters" of the head of the Carter family; and it attracted much more of notice for censure, than for applause or imitation. The comment of one of the neighbors was, that "whenever *he* should be obliged to make manure for his land, he should think it full time for him to move to the *back woods*,"—the name by which the more western settlements were then called.

With a few honorable exceptions, very few of the wealthy land holders, attended personally or regularly to the management of their farms, previous to the last 30 years. Still, some few excellent cultivators, and judicious managers of their farms, were profiting by pursuing a different course. Such were Philip Tabb of Gloucester, Fielding Lewis and John Minge of Charles City, and John Taylor of Caroline. The writings of the latter subsequently gave an impulse which may be considered as being the commencement of our improving state of agriculture, and with which the following recital will set out.

The 'Arator' of John Taylor, was published in a volume in 1813, and soon acquired a popularity, and a ready acceptance of its worst errors as well as its most valuable truths, which no other agricultural publication has obtained. The two most important improvements which the author thus made generally known, were both in regard to the using of vegetable matters as manure.

I. The making of farm-yard and stable manure, in which the vegetable materials are in very large proportion to the animal matter.

The first of these lessons, and great improvements on previous general opinion and practice, was the almost unheard of plan of using as litter all the vegetable offal of the crops, no matter how excessive the proportion might be to that of the animal excrement; or, in teaching a reliance on the fertilizing properties of vegetable matter as manure to soil, and food for plants, without regard to the amount of admixture of animal matter. And this, however universally understood now, so much, indeed, that the former state of general opinion can scarcely now be realized, was then totally new doctrine to nineteen in twenty of those who to it soon became converts. And the improved practice, thus brought about, was made the more extensive by another then novel lesson taught by Taylor, that the fermentation of manure before application was unnecessary and wasteful. Before that time, the little farm-yard manure which was made, was left exposed first on the yard, and next heaped, and in both states wasting, and the use lost, for a whole year before being used for the next crop of tobacco. The advantages and disadvantages of the different modes of preparing farm-yard and stable manure, of the different conditions when applied, will be again adverted to under a subsequent head, when the still newer practice of top-dressing on grass will be considered.

II. Manuring by "enclosing" or non-grazing, or excluding stock from fields when in grass, or not cultivated.

The next great improvement, and innovation on previous opinions and practice, was the plan of manuring fields by leaving on them, to die and decay, their own vegetable growth, whether of artificial grass, or, in its absence, of the weeds and other natural growth, whenever tillage crops

were not on the field. This, though it be Nature's own and universal mode of restoring fertility to impoverished lands, and therefore is offered to the observation of all persons, had not been practised before any where; nor had even the theoretical truth on which the practice rests, been received or considered. The plan may be claimed as an improvement entirely Virginian, in large and systematic use; and the first promulgation and extension of the practice was due to the mind and the labors of John Taylor, and especially to the publication of his 'Arator.' It is true, that this mode of fertilization is not suited to lands already in a productive state, nor where animal products are very profitable, or indispensable—nor where putrescent manures can be obtained by purchase, or from other foreign sources, more cheaply than to surrender the grazing of entire fields, however poor and bare of grass. But the system was, nevertheless, admirably suited to the general condition of eastern Virginia—nearly every farm of which presented much of exhausted, and miserably poor fields, producing, when grazed, very scanty sustenance to a half-starved stock of cattle, which, even if 100 in number on a particular farm, yielded very little return to the proprietor. One fourth of the number, if of well kept cattle, would have yielded more, in milk, meat, and labor, and nearly as much in manure. In fact, the gross product of the then large stocks of cattle on the farms of eastern Virginia, estimated at fair market prices, did not compensate their owners for the cost of keeping them, without including the enomous attendant expense of the fences dividing the several fields of each farm, and which were rendered necessary solely that nearly starved cattle might roam over the almost naked pasture fields. To adopt some other mode of keeping a much smaller stock, was of itself a great saving; and by so doing, all the natural growth of the fields, when resting from tillage, served to manure the ground on which it grew—giving back, in the large proportion formed from the air and water, perhaps twice as much of enriching matter as they had drawn from the soil. And however scanty might be the cover of weeds to the acre, the whole amount on the field would be greater than the owner could possibly have supplied to his farm in prepared vegetable manure; and moreover, it was already spread over the whole surface, and applied in the best manner, as well as produced without labor or cost. If the several fields of a farmer (under the then usual circumstances) were 100 acres each, and three in number, (the rotation, corn, wheat or oats, and rest,) while he could barely manure 10 acres of his corn field from the farm-yard and stable, and by naked summer cow-pens also, he could add thereto the slight but costless manuring of the 100 acres to which the rotation gave rest that year. Suppose this cover to the 100 acres to be worth but half as much as the other manure, (in the earliest practice, and the then most impoverished condition of the land,) the 100 acres so treated would at least receive the value of 5 other acres manured; and this would be adding at once 50 per cent. to the previous amount of manuring done, and that without any increased expense, or loss of other products.

But, great as was the improvement undoubtedly made by these two modes of vegetable manuring, there was much waste of effort, and much loss subsequently suffered, by applying improperly in practice the doctrines and instructions of Taylor, which were true in theory, and of which the application would have been profitable under other circumstances. It was necessary to learn, (what is now much better and generally understood, but what Taylor neither taught nor seemed to know,) that naturally poor land cannot be durably or profitably enriched by vegetable or putrescent manures, so as to be raised and kept above its original state of fertility. And on such lands, therefore, after a certain slight degree of improvement obtained, even the cheap manuring methods of Taylor were almost thrown away. And on better original soils, after being much recruited and enriched by such means, there are enormous and yearly increasing evils produced, in the troublesome weeds encouraged to grow, and the myriads of insects sustained by their growth, and which become depredators on the succeeding cultivated crop. Even the ploughing under the rank weeds on moderately rich land became a difficult operation; and, like the also difficult ploughing under of coarse unrotted manure from the farm-yard, was often very troublesome to tillage, and sometimes even injurious to the first tilled crop. But these objections do not lessen the merit of Taylor's "enclosing system," for a vast extent of impoverished fields, for the restoration and improvement of which, that system was not only profitable, but indispensable. The greatly increased and extended benefits of these and other applications of vegetable manures, were, however yet to be shown by the subsequent introduction of the knowledge and use of calcareous manures.

III. Marling, or manuring from beds of fossil shells.

This mode of fertilization, now so general through all the marl region of lower Virginia, was not practised except on three on four detached farms, and that to but small extent, before 1820. Some few and generally small experimental applications of marl had indeed been made, by different individuals, from 15 to as far back as 45 years before; but which applications, from total misconception of the true mode of action of calcareous manures, had been deemed failures; and without exception, of course, had been abandoned by the experimenters, as worthless; and the experiments had been almost forgotten, until again brought to notice, after the much later and fully successful introduction of the practice.

Henley Taylor and Archer Hankins, two plain and illiterate farmers, and near neighbors in James City county, were the earliest *successful* and continuing appliers of marl in Virginia. But at what time they began, and which of them was the first, I have not been able to learn, though visiting Mr. Hankins' farm for that purpose, as well as to see his marling, and making inquiries of him, personally, in 1833. Mr. Taylor had then been long dead, and his improvements said to be almost lost, by the exhausting cultivation of the then occupant of his land. Mr. Hankins was unable to say when he and his neighbor began to try marl. He was only certain that it was

before 1816. Yet, though these farms are within 12 or 15 miles of Williamsburg, to which place I had made visits once a year or oftener, yet I never heard an intimation of their having begun such practice, until some time after my own first trials in 1818. At that time, when led to the use, as I was, altogether by theoretical views, and by reasoning on the supposed constitution of the soil, as well as the known constitution of the manure, it would have been to me the most acceptable and beneficial information to have heard that any other person in Virginia had already proved practically the value of marling. The slow progress of the knowledge of the mere fact of marl having been successfully used before that time, was a strong illustration of the then almost total want of communication among farmers, as well as of their general apathy and ignorance, in regard to the means of improving their lands.*

Much earlier than the commencement of marling in James City, the practice had been commenced, (in 1805) in Talbot county, Md., by Mr. Singleton. His account of his practice is in the 4th volume of the 'Memoirs of the Philadelphia Agricultural Society,' dated December 31, 1817, and first published some time in 1818. But successful as was his practice, and also that of Mr. Taylor and Mr. Hankins in connexion with much worse farming, it is certain that neither of these individuals had the least idea of the true action of marl; and they were indebted to their good fortune, more than to any exercise of reasoning, that they received profitable returns, and did no injury by marling. They all three applied their putrescent manures with the marl. But though this was the safest and most beneficial plan, the thus uniting them prevented the separate action and value of putrescent and calcareous manures being known, compared, and duly appreciated.†

My own application of marl, on Coggins Point farm, Prince George county, which in 1818 extended only to 15 acres, (of which but 3 or 4 were under the crop of that year,) by 1821 had been increased to above 80 acres a year, and so continued until nearly all the then arable land on that farm requiring it, (more than 600 acres,) had been covered. In 1821, my earliest publication on the subject was made. Though the facts and reasoning thus made known by that time were beginning to attract much notice, and to induce many persons to begin to marl, still it was some years later before incredulity and ridicule had generally given place to full confidence in the value of the improvement. Even at this time, when nearly 25 years of my own experience of marling and its benefits have passed, and the results are open to public notice and scrutiny, not half the persons who could marl are engaged at it, or are marling to but little purpose; and of all who are using marl, nineteen in twenty are proceeding injudiciously, without regard to the mode of operation of the manure, and therefore are either doing harm, or losing profit, almost as often, though in less degree, as doing good. At this time, however, there are scarcely any persons, however negligent in practice, who do not fully admit the great value and certain profit of applying marl whenever it is found.

But with all the existing neglect of using this means of fertilization, and with all the still worse ignorance of or inattention to its manner of operating, there never has been a new improvement in agriculture more rapidly extended, or with such beneficial and profitable results. In Prince George county, there is not one farmer having marl on or near his land, who has not applied it to greater or less extent, and always with more or less profit—and, in most cases, largely as well as profitably. In James City county there has been perhaps the next largest as well as the oldest practice. In York county, as in James City, some of the most valuable and profitable improvements by marling have been made. And some of the farms of both counties, adjoining Williamsburg, and having the benefit of putrescent town manures, show more strikingly than any others known, the remarkable power of calcareous manure to fix the putrescent in the soil, and make them more efficient and far more durable. In Surry, Isle of Wight, Nansemond, Charles City, New Kent, Hanover, King William, King and Queen, Gloucester, and Middlesex, counties in the middle of the marl region of Virginia, marl has been already extensively applied, and the profits therefrom are annually increasing. And in other surrounding counties, worse supplied with marl, the practice has been carried on in proportion to the facilities, and to the more scanty experience and degree of information on the subject. It would be a most important statistical fact, if it could be ascertained how much land in Virginia has already been marled. The quantity however is very great; and all the land marled has been thereby increased in *net* product, on the general average, fully 8 bushels of corn or oats, or 4 bushels of wheat—and the land increased in intrinsic value fully 200 per cent. on its previous value or market price. Where the marling has been judiciously conducted, these rates of increase have been more than doubled. From these data, might be calculated something like the already prodigiously increased values and products due solely to marling, and which will be still more increasing from year to year. If not already reached, the result *will* soon be reached, of new value to the amount of millions of dollars having been thus created. It is not designed in this hasty sketch to enter into minute details of results, nor to prescribe rules for practice, both of which have been given in other publications. The purpose here is but to state improvements and describe results in general.

It required the improvement by marling, on originally poor or middling soils, (or liming, which in final and general results is the same thing,) to render as generally available the best and otherwise but rarely found benefits, of the two kinds of vegetable manuring recommended by Taylor. When such soils have been made calcareous, by marling or liming, then, and not until then, all the benefits, present and future, that his readers might have been induced to ex-

* See more full account at page 108, vol. i. Farmers' Register.

† See Mr. Singleton's letter, p. 228, vol. iv. Philadelphia Memoirs, and republished, with preliminary comments, p. 89, 2d Ed. of 'Essay on Calcareous Manures'. Also notices of other earlier experiments at same page, and in note at page 36.

pect, may be confidently counted upon. In my own earlier practice—and Taylor had no greater admirer, or more implicit follower—I found my farm-yard manurings on acid soils scarcely to pay the expense of application, and to leave no trace of the effect after a very short time. And land allowed to receive for its support all its vegetable growth (of weeds and natural grass) of two and a half years in every four, and the products in corn having been measured and compared, showed no certain increase in more than twenty years of such mild treatment. Since, on the same fields, farm-yard manures, in every mode of preparation and application, always tell well, both in early effect and in duration. And even the leaves raked up on wood-land, spread immediately and without any preparation, as top-dressing on clover, always produce most manifest improvement, and are believed to give more *net* profit than any application of the much richer farm yard manure, per acre, made on like land before it was marled. This utilizing and fixing of other manures, and the fitting land to produce clover, which effects of marling are in addition to all the *direct* benefit produced, would alone serve to give a new face to the agriculture of the country. Whatever may be done by clover, and almost every thing that can be done to profit by vegetable manures, on the much larger proportion of the lands of lower Virginia, will be due to the application of marl or lime.

IV. Liming.

The kindred improvement by liming began to be extensively practised on some of the best James river lands, where no marl was found, soon after the use of the latter began to extend. Who may have made the earliest and small applications of lime is not known, nor is it at all important. The earlier profitable use of lime in Pennsylvania, and the much earlier and more extended use in Britain, were known to every well-informed or reading farmer. Such a one was Fielding Lewis of Charles City, as well as a most attentive, judicious, and successful practical cultivator and improver. He is believed to have been the earliest considerable limer, and the one who obtained the most manifest profits therefrom, and whose example had most effect in spreading the practice. Some of his disciples and followers have since, in greater rapidity and wider extent of operations, far surpassed their teacher and leader—to whom, however, they award the highest meed of praise for bringing into use, and establishing this great benefit to the agriculture of lower Virginia. Nearly all the best soils on James river are comparatively of low level, as if of ancient alluvial formation, and have no marl with which the neighboring higher and poorer lands are mostly supplied. Of such rich lands, are the farms of Weyanoke, Sandy Point, Westover, and Shirley, &c., in Charles City, and Brandon (Upper and Lower,) in Prince George—and on all these lands, as well as some other, lime has been largely applied. The use is extending to the lands on all the tide waters of the state; and it has recently received a new impulse from the low price at which northern stone-lime is now brought and sold. It is ready slaked, and the vessels are loaded in bulk. The lime is sold on James river at 10 cents the bushel, and even may be contracted for at 8 cents, from vessels that come for cargoes of wood, and would come empty but for bringing lime. The greater lightness and cheaper transportation of lime, will enable it to be applied where marl could not be carried with profit; and with the two, there will be but little of lower Virginia which may not be profitably improved by calcareous manures.

V. Introduction of clover, and its application directly as manure.

As has been already observed, incidentally, the clover culture of Virginia is due to the previous use of calcareous manures. Without enough of lime, or some combination of lime, to constitute a really good soil, and still more on sandy lands, as most are in lower Virginia, it is almost impossible to raise clover at all, and always unprofitable to attempt it in field culture, and as part of a regular rotation. It is true, that on some of the best and richest natural soils, such as were just above named, and on the repeatedly and long manured house lots of worse original soils, some good clover had been made. But even there, the products were precarious. Field culture of clover was out of all question, and failed wherever attempted in lower Virginia, except on the best and very peculiar natural soils. It may even be doubted whether it was any where so productive, and so certain, as to be a profitable and regular manuring crop of the rotation. But after marling or liming, clover grew much better on the few places on which only it could be raised at all before, and it also became a crop as sure as any other, and *naturalized* as it were, on the before foreign and altogether unsuitable soils. It is true that marl or lime, alone, will not produce heavy crops of clover on very light or other very poor land. But even there, a good and healthy "stand" of clover is readily obtained, the plants taking and keeping possession of the ground, and are fit to be raised to a heavy crop by other auxiliary means—such as putrescent manures, and also gypsum, and perhaps green-sand. For according to the present feeble and uncertain lights on both the latter substances, the balance of testimony, furnished by my own experience and the operations of other persons in lower Virginia, is in favor of their acting well as manures on clover generally on naturally calcareous or marled and limed land, as well as of their having no useful effect an acid soils.

Clover is a most valuable addition to the comforts and minor profits of a farm, and also as an indirect fertilizer, by increasing the supply of animal manure. But its great benefit is different from, and superior to all these—and is to be secured by the crop being turned into the soil, and thus serving directly as manure for the crop of wheat to be sown thereupon. This process of culture, and mode of manuring, though not original in lower Virginia, but derived from the upper country, is believed to be peculiar to the United States. For though it be called by the same name, (fallow,) as is the best preparation for wheat in Britain, the two processes, and their designed and actual effects, are altogether different. In Britain, the object is to cleanse a field which had become foul with the grass and weeds which had been encouraged to grow and take possession of the land, by the moist climate, and

the want of enough hoed crops (like our Indian corn,) in the British rotations. And the object is effected by repeated ploughings and cross ploughings, harrowings, raking and hand-picking of root weeds, continued at intervals through a whole year, during which the land is kept as naked as possible. On the contrary, in the perfection of what is so improperly called "fallow" for wheat in Virginia, a heavy growth of clover is raised, and the second crop, if not also the first, (as is the practice of some of the best farmers on James river,) is left ungrazed and unmown, to be well turned under in August or September, by good ploughs drawn by 3 or 4 horses; then to harrow the new surface, and close the seams between the furrow slices; and without more stirring of the earth, (if possible,) to sow wheat thereupon, at the proper time, and cover the seed with harrows if soft, or such other shallow cutting implement, as the degree of hardness of the surface may require. The object is to have but one, and that a good ploughing; (unless the quantity of wire-grass or blue-grass compel a subsequent shallow ploughing;) and this restriction to one ploughing is not only to save labor, but to secure the clover manure below, and out of the way, and to keep a clean surface above, of which the tilth and mellowness are maintained by the gradual yielding and sinking of the mass of clover turned under. Such a coat of clover is an excellent manuring for the wheat succeeding, and moreover has been obtained at small cost, as its broad leaves drew its principal nourishment from the atmosphere. The smothering growth, also, of thickly set and rank clover, serves to keep the land clean of almost every thing but the clover itself, which is ploughed under deep enough to be effectually put out of the way of the succeeding wheat. The total and sudden change, also, of the condition of the field, by the ploughing and complete burying of the clover, and the leaving for some time a perfectly bare surface, must serve to starve and destroy nearly all the depredating insects that fed on the clover, and which, if not thus destroyed would continue to feed on the wheat. Thus *wheat on clover*, if well managed in all respects, is an admirably clean crop, both from weeds and from insects, and is heavily manured by the clover, which experience has proved is well adapted as a manure for wheat. Hence, it is not strange that the very best crops of wheat that can be obtained from the land, are raised by this mode of manuring with clover.

In speaking above of the practice of ploughing in clover to precede wheat, as being peculiarly American, it was only meant in reference to it as in regular and profitable use, and forming a part of the ordinary system of rotation and culture on some farms. The like explanation and understanding should be applied to several other things spoken of in this piece, as new improvements here. It is certain that the ploughing under of various green crops, as manure, and especially clover, has been sometimes done in Britain in modern times, and still more formerly in Greece and Italy, judging from the recommendations of the practice by ancient writers. "But," says Sir John Sinclair, "notwithstanding the recommendations of the ancients—notwithstanding the great need of manure—and the excessive price of every extraneous article of that description—this practice is now in a great measure abandoned. Peas, buck-wheat, clover, and other juicy plants, when ploughed in, yield no doubt a portion of manure; but they do little more than *restore* the nourishment they had abstracted from the soil; whilst it is extremely difficult to plough down rank vegetables in a growing state, so as to cover them in a complete manner. The farmers of Scotland are, therefore, of opinion that the only way of securing the highest degree of benefit from green crops, is to cut and bring them into a state of putrefaction, before they be applied to the soil." (General Report, &c., of Scotland, vol. ii. p. 530.) That, in the very different circumstances of Britain, the ploughing in of green clover may be bad economy, may be admitted, without affecting the propriety of the practice in Virginia. The like admission may apply to sundry other processes which are proper and economical and preferable here, and which would be the reverse in Britain, in Flanders, and still more in China. But the distinguished and able agriculturist above quoted was altogether wrong in his main theoretical ground of objection, viz.: that crops ploughed under only *restore* to the soil as much as they had previously abstracted. He forgot, or was not aware of the much larger portion of their substance which most plants, and especially clover and other broad-leaved plants, draw from the atmosphere and form into substantial vegetable matter, from the elements of air and water. But for this, the most bountiful provision of nature for the productive power of the soil, the draught therefrom on every farm, would regularly exceed the returns by manuring, &c., by the whole amount of crop sold off; and certain and rapid exhaustion, would necessarily be the consequence, to every part of the cultivated face of the earth, not regularly and abundantly supplied with putrescent manures from abroad. Yet all know that but a small proportion of the products of a field being returned as manure, will serve to maintain, and under favorable condition of soil, &c., may even greatly increase its productive power.

Perhaps there is no improving process or general practice, of one country or district, and however peculiar to it, that has not been used in some, and it may be many, isolated cases elsewhere. But, the very fact of such trials, however numerous, being rare and remaining separate, and not becoming general practice even on a few farms, is enough to prove that the processes or plans were not found profitable—and that such practical operations were but exceptions to the general rules of approved procedure. If there is any one of the modes of enriching by putrescent matters here spoken of, which might be supposed altogether new, it would be the plan introduced by Taylor, of manuring land by its own vegetable cover, wholly or in part, left to decay on the fields. Yet even this was advocated in Scotland, by Lord Belhaven, in 1707, and his publication is quoted by Sinclair, for the purpose of strongly condemning the opinion. The passage from Lord Belhaven is as follows: "I must say, by-the-by, that if in East Lothian they did not leave a higher stubble [when reaping grain,] than in other places of the

kingdom, they would be in worse condition than they are, though bad enough. A good crop of corn makes a good stubble; and a good stubble is the equallest enriching that can be given." (The Country Man's Rudiments, p. 23.) On which Sinclair remarks, "Such sentiments are now condemned by the practical farmer, whose object it is to cut and to bring home the whole, or nearly the whole straw; under an impression that, *unless it be brought into a putrefied state in the fold yard, little advantage, as a manure, can be obtained from it.*' (General Report, &c., of Scotland, vol. ii. p. 510.)

VI. Top-dressing with putrescent manures, and especially on clover.

After allowing all merit due to the improvement to be made by collecting, and to the greatest possible extent, more vegetable materials for farm-yard and stable manure—and also for the greater benefit of applying such manures on lands marled or limed, there would still remain a powerful obstacle to the extension of manuring, in the enormous amount of labor required, on Taylor's proposed plan, to carry out the manure in the spring, and plough under for corn before planting—to say nothing of the difficulty of tillage, and of danger to the young plants in dry weather, by the presence of 50 large ox cart loads (4 oxen for each,) per acre, the quantity of which he speaks. In so short a time, and in a busy part of the year, it is impossible, with the ordinary force of the farm, to carry out, spread, and turn under in proper manner, all the manure that could be made from all the offal of a grain farm—independent of the leaves and other materials which ought to be used. If, to lessen these difficulties, the manure be earlier heaped and fermented, then indeed it is made more manageable and more speedily operative; and the time for applying it is extended. But, on the other hand, the *whole* labor is increased, and the manure loses much of its fertilizing principles by fermentation. A third choice remains, which is to leave in the farm-yard, without heaping, and undisturbed, either all the manure, or all that cannot be conveniently carried out before planting the corn land intended to be so manured. The balance, or the whole so left, rots slowly through the summer, and may be carried out in September on the clover land, to be ploughed immediately for wheat; or otherwise kept until the next spring, to be ploughed under for the corn crop. In the first case, there is lost the use of the manure for six months, and in the second for a whole year; and in both, during the delay, the manure must lose much of the gaseous products of decomposition, which there is nothing growing to receive and secure. I have tried and suffered loss by all these three courses; and was fully sensible that in all, either the waste of manure, or the loss of its use by delay was very considerable.

The plan of top-dressing is an admirable means of overcoming most of these difficulties—and indeed all the important difficulties, if there be no *greater* waste of the fertilizing principles of manure spread on the surface of the soil, and no less benefit to the growing crop, than if the manure had been buried by the plough. Both these points are disputed, and there have been no careful or conclusive experiments made to decide the question. But from my general experience and observation, and now general practice for 12 years, I am satisfied that the evil of the greater waste of manure or of its effects, if indeed there be any greater, is not to be compared to the great saving of expense, found in applying the manure as top-dressing on clover, in March and April, or even somewhat later. When thus applied, and spread evenly and immediately, as it should be, the first rain carries into the earth all the soluble and active parts, and they are absorbed immediately by the roots of the clover, the growth of which will show the benefit in a few days. The coarse parts of the manure, are soon covered over and kept shaded and moist, by the growth of the clover, and thereby the rotting is both hastened, the products preserved better from waste; and every rain carries to the roots, and puts them to immediate use, as food for the growing plants. Thus, a good growth of clover is made even on inferior land, and perhaps by food that might have mostly gone to waste, if the manure had been fermented and made hot in the heap—or more slowly, by lying spread during all summer over the cattle yard. And this clover manure, being more than half derived from the atmosphere, would be worth to the succeeding crop of wheat or corn, more than double the prepared manure it fed upon and consumed. The saving of labor also is great. The mode of application permits the manure to be carried out in any state, from the time of the earliest beginning of the spring's growth of clover, to the first of May; and, if not before so used, even if put out at any time in summer, would do as well, except that the benefit of helping the earlier growth would have been missed. But as to summer-made stable manure, which is so generally injured by fire-fanging, if bulked, or wasted, if spread open in the stable yard, it is decidedly better to spread it on clover, during all summer.

The best application of top-dressing is to clover, because every portion of the manure so used by the clover, is converted to (probably) double the value of the manure in clover, ready to be again used by the wheat the same year. But though clover, as a broad-leaved leguminous plant, (or of the pea tribe,) draws more of its nourishment from the atmosphere, and gives more of manure to the next crop, than any other grass, still, if clover were not at hand, the top-dressing should be given to any grass or any weeds that stood thick enough soon to cover and shade the manure, and to increase the growth of which would be beneficial to the land, and to the succeeding crops.

But there is another material for top-dressing to which there can be no objection on the score of supposed waste, or because any thing better or more economical could be done with it, and which application is highly beneficial. This is leaves raked up in wood-land, and laid on young clover, in winter or spring. Valuable as is this material, on account of its abundant quantity, and usual cheapness of supply, it is very poor in quality compared to straw; and would perhaps not be worth the labor of double hauling and twice handling, required to carry it through the farm-yard to prepare it for manure. And dry or unrotted leaves would be very troublesome to plough under, and if thick might do more harm than good.

But when spread on clover, not too thickly, immediately from the woods, there is little trouble, no possibility of injury, and a decided improvement to the clover, and of course to the next wheat crop, and to the land. Wheat straw, spread in July, or later, on the young clover sown the year before, is also a valuable manure; and may be applied most advantageously on the poorest spots, by bringing back to the field return loads of straw, when carting the wheat from the field to the thrashing machine.

Another, and perhaps the best mode of dressing by pine leaves, (which are best, because they will not be blown away by high winds,) is on wheat, as soon as possible after it is sown. This is too busy a time for much of such manuring to be then done. But it will be especially beneficial to such extent as it can be done. When so applied, the leaves, merely as covering, protect the wheat from being killed by the winter's cold, and from violent alternations of temperature. And they do the same for the clover sown afterwards, and also protect the young plants by shade and moisture. And besides these merely mechanical modes of action, the leaves serve as well as manure, both to the wheat and to the clover, as they could in any other mode of application. An important objection however to this mode may exist if the leaves serve to shelter and protect chinch bugs, as coarse farm-yard litter does, if thus laid on wheat, when those destructive insects are numerous.

Two other modes of top-dressing have been practised and approved by good farmers, in different parts of Virginia. The first is of well-rotted manure, applied on wheat during winter and spring. It was practised by Mr. Richard Sampson, and his account of it may be seen at page 58 vol. i. of Farmers' Register. The practice is doubtless good when manure so rotted is on hand, and the most convenient application is to the wheat field. The other mode, which was in use on some of the Rappahannock farms, was to apply the coarse unrotted manure on the surface of the corn-field, after the corn had been planted, or had come up. I have also practised this plan when much more convenient to do so; and would care but little to choose between this top-dressing and ploughing the manure under, before planting the corn. But neither to wheat or corn ought the top-dressing to be given, if the clover land is as convenient, and as much needing the manuring.

VII.—Rotation of crops.

One of the best indications of the agriculture of any region being in an improving state, though this improvement be not yet much extended, is the regard recently paid to the proper principles of rotations of crops. And if no regard be had to this part of husbandry, there will not be good farming, no matter what may be the goodness of the soil, or the industry and skill of the cultivator. If judged by this test, the agriculture of lower Virginia is making good progress towards an improved state, though yet very far below the point aimed at. There is no rotation universally admitted to be the best, even under the same and most favorable circumstances. But almost every intelligent farmer at least exerts his reasoning faculties on this subject, and adopts such rotation as his judgment makes out to be the best for his particular circumstances. Still, no one of even the best farmers and most successful improvers, seems to be entirely satisfied with his own system of rotation. And this very discontent serves to prove that each one is striving to find out and to pursue what is the best course, without being bigoted to even that which he so far prefers. These remarks however apply only to a few of the best farmers; who, however, as in all cases when agreed themselves as to the best courses, will serve as exemplars and guides to all others who can or will profit by any instruction or example.

The Eastern Shore two-field rotation, of 1st, corn, 2d, oats, followed the same year by volunteer Magothy bay bean, serving as a manure crop for the corn of the next (the third) year, however scourging, without great attention to manuring, is a rotation sustained by reason, as well as by experience.

The old three-shift rotation, common on the greater number of farms which have any rotation at all, or where there is any thing deserving the name of farming, is 1st, corn, 2d, wheat or oats, 3d, the field at rest from tillage, but under close grazing. This is a most exhausting course. But the same frame-work, altered only by the land being limed, regularly sown in clover on the wheat, and the clover grazed only slightly and late in autumn, and the greater part turned in for manure, is a very improving, cleansing, and altogether excellent rotation for light loams, or good corn lands. This is the rotation on the lighter of the two Upper Brandon farms, belonging to Mr. Wm. B. Harrison.

The rotation most approved, however, and most practised by the best farmers on James river, and also on the lighter soils of the Messrs. Wickham, on the Pamunkey, is the four-field rotation, of 1, corn, 2, wheat, with clover sown, 3, clover, turned in for manure to 4, wheat. This seems to be a very severe rotation, and is even so considered by some of the best farmers who pursue the plan. However, this rotation, with all the objections to it, both theoretical and practical, is connected with and serves to exhibit most admirable and profitable farming, and also improvement of land such as may well compare, in these respects, with any in this country. Such a rotation *demands*, and will not do without, a good soil, good manuring, good clover, (and therefore marling or liming, or a naturally calcareous soil,) good teams and good ploughing, and in every respect good farming. He who can meet all these requisitions will succeed admirably, both as to profit and improvement, with the four-field rotation; but if he falter in the work, he will be soon obstructed by insuperable difficulties, and be defeated, and driven from this course of cultivation.

VIII.—Implements of husbandry and tillage.

Great improvements have been made within the last 25 years in agricultural utensils and machinery. Before that time, two-horse ploughs were rarely used, and only on the few richest and best cultivated farms, for breaking lands generally, and on the rich low-grounds and perhaps a few acres more of lots, on some other farms of middling grade, as to fertility and management. On the far greater number of farms there was neither a two-horse plough, nor a mould-board plough for

a single horse. Ninety-nine acres in the hundred were broken up by one-horse ploughs; and half of the whole quantity with the trowel-hoe, or fluke-hoe plough, having cutting wings to the share on both sides alike, and no mould-board. The ploughing was rarely deeper than three inches, (often less,) and even that depth, on the naturally poor lands, often reached the barren subsoil. Harrows, and the advantages of harrowing, to get rough ploughed land in good order, which no farmer can now dispense with, were scarcely known. On most farms, the only approach to a harrow was the "drag" with large wooden teeth, used to smooth newly sown wheat land, after the seed had been covered by the trowel-hoe plough. The wheat was almost universally trodden out of the straw by horses (sometimes aided by oxen) on the earth, and out of doors. Thrashing machines, (and those very inferior, on the old Scotch plan,) were not on half a dozen farms on James river, and perhaps not thrice as many in all eastern Virginia.

It can now scarcely be conceived how land could be broken up, and left in tolerable order by such ploughs and ploughing. Nor could it be done on even the poorest land, if suffered to be at rest long enough for its surface to be clothed with grass, or the earlier and more scant growth of weeds to remain. But most of the farmers who broke up their corn fields with trowel-hoe ploughs, secured the feasibility of the process by cultivating the land in corn every other year, and grazing as close as possible the intervening years. Of course there was no turf, and scarcely a living root, on poor land. Very many did not break up the land at all, at first, but merely ran a furrow with the trowel-hoe ploughs along each of the former corn-rows, checked by similar cross-rows, then planted, and ploughed the intervals at leisure some 6 or 8 weeks after, when the corn was several inches high. Many persons objected altogether to using mould-board ploughs, believing that turning over the furrow slices would exhaust the soil by greater exposure to sun and air.

Since, perhaps the error has been in the opposite direction. Many improving farmers have been even too ready to buy new and highly priced ploughs and other implements; and there are but few who have not had to throw aside, as worthless, at least as many kinds of new implements as they have retained. However, ploughs of good construction are now in general use. Two-horse ploughs are common wherever there is any farming better than the worst; and three-horse, and even four-horse ploughs are used where the natural depth or subsequent improvement of soil requires ploughing 8 or more inches deep. Good thrashing machines, either fixed or portable, of several kinds, are in general use, except on very small farms; and many a large wheat farmer would now abandon the culture of wheat, rather than to have to return to treading out every crop, as formerly.

The processes of tillage have improved with the implements for tillage; and imperfect as both yet are, these two improvements are now more advanced than the more important improvements of the fertility of the soil, and the preservation and economy of the means and resources for fertilization.

Defects of agriculture still remaining.

What has been said of improvements made, will prevent the necessity of treating of the remaining defects of agriculture at much length, copious as may be that subject. The most important defects may be despatched in a few words, as they are either the omitting, or negligently and imperfectly executing, any such of the foregoing named improvements, as may be suitable and wanting to the particular circumstances of each farmer. But there are also minor branches of these several general subjects, and also other distinct subjects, of neglect or omission, which remain to be briefly considered.

In regard to the application of marl—although it has been more universally or generally and extensively adopted and practised than any other as new and as great innovation in agriculture, and although the unusual rapidity with which the new practice has spread, is as remarkable as the extended space of operations, still very few of those farmers who have adopted this mode of improvement have operated properly, or to half the profit that even their actual expense therein, if properly directed, would have returned. The far greater number of persons commence and continue the always heavy business of marling, without providing for it any additional force, or suspending any of the previous cultivation and full employment on their farms. Few had before been able to perform properly all the ordinary labors required; and yet they count on marling their whole farms with no more labor than was before engaged. They marl only "at leisure times;" and for want of regular and continued operations, very little can be done at all, and that little at double cost. But suppose that there were no such disadvantages, but only the slower rate of work, and that the owner of 600 acres to be marled, could cover 10 acres a-year at odd jobs and leisure times, or 100 acres by merely suspending a third of his cultivation, and devoting the labor so released to regular and continued marling. In the first case 36 years would be required to marl the whole surface, and in the latter only six years. In the latter case there would be no diminution of product by the lessened tillage, even in the first year; for the two-thirds of the first field marled would yield, in the first year, more (and usually much more) than the whole without marling. And the increased rate of product of the farm, at the end of the 6 years serving to marl the whole, would more than pay for thrice the labor usually required for the marling. The mere difference to the farmer of having his land all marled, say in 1842, or not until 1852, would be the loss of the increased product for ten years. And on most of the lands of lower Virginia, that increased product, from marling alone, would be equal to half the gross product, (or 100 per cent. on the original product,) and would amount to more in 10 years than the previous fee-simple value of the whole farm. He who has determined to marl his land, and yet delays to do it, is thereby submitting, during the delay, to a loss in every crop fully equal to all that is made on the unmarled land in tillage.

But putting aside this enormous waste of value, incurred by mere delay of operations, the marling actually done, (and at double cost, from irregular working and want of method,) does not yield

half the available returns, because of ignorance or carelessness in the application, and the subsequent treatment of the land. Frequently, the quantity applied is unsuited to the nature and wants of the soil. Sometimes, from variation in the strength of the marl, and the proprietor being ignorant of the quality, or, more often, from irregular spreading, injury is done, and loss sustained, by there being too much marl on some parts, and too little on other parts, of the same field, and sometimes even of the same acre. Again, i the time and manner of application be never so judicious, and the improved fertility be never so great at first, half the surely available future profit will be lost, if the subsequent management be as improper as it usually is in almost all cases. Under ordinary tillage and management, and a rotation merely *not* exhausting, (say the three-shift, without clover and without grazing, and very little manuring,) marling may, and probably will, give a *permanent* increase to the crops of between 50 and 100 per cent. But if clover be sown, and partly or wholly ploughed under as manure, and if the *increased* supply of materials for farm-yard manure be all used, (which also will be due entirely to marl,) these means will in a few years double the direct effects of the marl alone. The whole permanently increased product, thus to be made by the most judicious marling (and the same, it is presumed, of liming,) and subsequent operations, on the ordinary acid soil of lower Virginia, might be safely counted as four-fold the previous gross products; and a ten-fold increase of the net profit, and also of the intrinsic value of the land. Yet the loss, or failure to obtain, the much larger proportion of this increase of value is borne by nearly all of those who apply marl, because they will not attend to the properties, and the mode of operation of the manure which they are using.

Having begun to marl without any guide whatever, or source of proper instruction, except my own theoretical views of soils and manures, I have myself committed more or less of every serious error above referred to, and suffered something from every kind of loss; as well as having realized enough of every benefit promised, to know what greater and more speedy general profit a proper conduct throughout would surely produce. My mistakes and losses, necessarily caused by the ignorance and inexperience of an uninstructed novice, and pioneer in a totally new business, may serve to guard from the same all followers; and they, being so guarded, may enjoy all the benefits of marling, unalloyed by any of the risks and losses of ignorant beginners. But it is a subject of regret, and of great public as well as private loss, that the actual results are very different. It is as if each new beginner were resolved to learn nothing from the previous experience of others, but prefers to owe all knowledge to his own errors and losses.

In regard to putrescent manures, there are very great and very general defects of management. On acid soils there is excuse for neglect of manuring, for it scarcely pays the cost. But on well constituted natural soils, and on naturally acid and bad soils, after being marled or limed, too much labor cannot well be given to collecting all the farm materials for, and applying putrescent manures. But even of the quantity of materials operated on, in the farm-yard and stables, there is great waste of enriching principles permitted, in various ways, but more especially by fermentation, whether the manure be heaped, or not heaped, or carried out on the fields before rotting. And such waste must take place, if decomposition of the manure proceeds, and its gaseous products be set free, when there are no growing plants present, or not enough of them, to absorb and put to use the fleeting fertilizing principles.

The neglect of proper drainage is another great defect of our agriculture, affecting not only the profits, but the health of the lower country. On almost every farm there is something of this defect. But in the low and level lands of the south-eastern counties, the whole region suffers from excessive wetness, which might be easily removed by a proper system of drainage and of tillage suited to that object. Princess Anne and Norfolk counties might be raised from their present most wretched agricultural condition, to their proper grade of fine and productive and valuable farming lands; and even the rich lands of Elizabeth City, and the now fertile and productive farms of the more carefully cultivated and beautiful low lands of Gloucester, might yet be greatly improved in value, by more thorough and general drainage.

A great defect on almost every farm to some extent, and entirely on most land, is the neglect of grass crops for hay. Even the small extent of clover husbandry, admirable and profitable as it is, scarcely forms an exception to this defect; for the clover is turned in for manure, and rarely converted to hay. On some of the best farms, and where the benefits of clover-manure have been best known by experience, as Westover and Brandon, the proprietors deem this use so much the more profitable, that they would consider the conversion of any considerable portion of the clover crop to hay as a wasteful abstraction from the product of the field under the succeeding crops. But without undervaluing the worth of clover as manure, I doubt whether these excellent farmers and improvers do not in this respect adhere too closely to their system. Before forming the seeds, which is the exhausting part of the growth, the clover has drawn nearly all its nourishment from air and water, and taken very little from the enriching ingredients of the soil. If then the first crop were mown for hay, before the seeds had been formed, there would be the following benefits derived, at very slight cost to the land: 1st, the hay, for farm consumption, 2nd, the cutting off by the scythe and destroying all annuals not then having seeded—and the keeping down of all perennial weeds, shrubs, and bushes; 3d, the having a clean second or summer growth of clover, to furnish seed if desired, or otherwise thus made free from the smothering and sometimes destructive cover of the dead first or spring crop. Of course, the mowing should be on clover of good size, and where the coarse manure had not been applied.

But putting hay from clover aside, there is general neglect of natural meadows, and still more of artificial grasses on the low and moist spots, which would be very profitable under permanent grass, and are worth but little as arable land. Yet hay, either for sale if near to market, or for consumption on the farm where needed, is per-

haps the most valuable crop of suitable land, and certainly the crop most cheaply made. For want of attention to grass husbandry, our towns continue to be supplied with hay imported from New England—and our corn crops are stripped of the leaves for fodder, though the cost of labor so employed, and the injury to the grain, must amount to much more than the value of the fodder so obtained.

A region in which hay is scarcely made at all, and grass so much neglected, must necessarily also show poor live stock, and small profits therefrom. To both these bad courses we have been seduced by the quantity of cattle-forage furnished in the offal (shucks and stalks) of our large corn crops. But all that even this bountiful supply permits, is that the cattle may live, gradually becoming poorer, through winter and spring, and yielding through the year little or no net profit, except in furnishing supplies necessary to the comfort of the family, in milk, butter, and meat, and of manure to the land.

We raise not enough hogs, for the home supply of what is the principal animal food of the country; though this great defect is rapidly becoming less. We raise very few horses for labor. Sheep are not to be found at all on most farms, owing in a great degree to the risks they would incur from dogs. If every useless and worthless dog in lower Virginia were a sheep or a hog, the expense of maintenance would be less, and the returns to agriculture greater by many thousands of dollars, besides the rendering the raising of sheep in general safe and profitable, instead of being as hazardous as if the country were infested by wolves instead of by worthless dogs.

ON THE COMPARATIVE MERITS OF THE ISABELLA AND CATAWBA GRAPES; WITH A NOTICE OF A NEW NATIVE VARIETY CALLED THE OHIO GRAPE, AND OBSERVATIONS ON THE CULTIVATION OF GRAPES FROM SEED.

By N. Longworth, Esq., Cincinnati, Ohio.

From the Magazine of Horticulture.

I was surprised on reading a communication in your magazine, (vol. vii., p. 331,) from an intelligent gentleman at Marietta, Ohio, in which he speaks of the Isabella grape as the best native grape cultivated by them, and that they commence using it for the table as soon as it assumes a red color. I should suppose he alluded to the Bland Madeira, did he not speak of that grape in a subsequent part of his letter. I have ceased to cultivate the Isabella for near twenty years, deeming it inferior, as a table and wine grape, to most others. He gives it the preference over the Catawba, as a table grape; with us, it ripens badly, and is subject to rot, and in its best state far inferior to the Catawba, either for the table or for wine. I have had a bunch of the Catawba to weigh twenty-four ounces. I have a white variety of the Catawba, and another Catawba producing fruit a third larger than the Catawba of Adlum. I say the Catawba of Adlum, for Major Adlum was the first to bring it into notice.

I have three varieties of native grapes, which I consider far superior to the Catawba for the table. They have none of the hard pulp common to the Catawba, Schuylkill, Muscadel, and the Isabella. For the table, they are equal to the Meunier, or Miller's Burgundy, and as free of pulp. One of them, which I first met with a few years since, I call the Ohio grape. The vine is perfectly hardy, a fine bearer, has never had the mildew or rot, and the bunches very large, say four times the size of the Burgundy. I sent a bunch of these grapes to Boston, last fall, but it was too long on the road to be in perfection. I will give five hundred dollars for a root of a native grape, that in quality of the fruit and size of the bunch, shall surpass it. The other two are equally good for the table, perfectly hardy, great growers, but the bunches of fruit are not so large.

I was surprised, when east, to find no good native grapes. At my different vineyards, I have about sixty acres in grapes, but not all in bearing. Last season, I had not half a crop, with the exception of one vineyard, where the fruit was abundant and fine. I made about two hundred barrels of wine, and some brandy. I am now raising large quantities of vines from the seed of my best varieties of native grape, having cleared a piece of new land expressly for that purpose.

The Bland grape is not a native. It was introduced into Virginia from France, about fifty years since, by a French gentleman, as I was informed by Gen. Harrison, who knew the gentleman, and had seen the fruit on his table, more than forty years since. It is a good table grape, but subject to mildew, and does not always ripen its wood or its fruit. Yours, respectfully,

N. Longworth.

Cincinnati, Ohio, March, 1842.

LIQUID MANURE.

From the (London) Farmers' Magazine.

Sir,—I beg leave to state to you that, seeing the bad effects of the waste of the draining of manure heaps, and being convinced that much of the substance of the dung was contained therein, I determined on applying it as a top-dressing to a meadow, which was effected in the following manner:—Measures having been taken to prevent the escape of the water, an old tar barrel had a hole about six inches square cut out at the bung; into this was fitted a funnel made of wood, somewhat in the shape of a hopper, having the bottom covered with a piece of old tin perforated with holes, to act as a strainer to prevent straws, or any matter which would choke the passage, getting into the barrel. Two old felloes of a cart wheel, having wedged-shaped pieces nailed on the outer side at each end to keep them steady, were laid in a cart, and the barrel having a hand-plug in the cock hole, was laid on them. A trough a foot longer, the width of the cart, one side of it being bored with a double row of holes burned with a hot iron, was then slung behind, and just under the cart; which, when the cask had been filled with the dunghill water, was then driven on the meadow—the plug being withdrawn, the water flows out on the bottom of the cart and thence into the trough, which through the holes distributes it in the manner of a town watering cart. This apparatus is simple, cheap and effective; and when done with, the

trough and the barrel can be put by, and need not monopolize a wheel carriage for this particular use.

In going over the ground, the cart should be driven right up and down hill; as if it goes sideways or across the hill, the water will not flow equally from the holes, but will be in one end of the trough; and the track of the wheel points out to the driver where he is to go next turn. The effect with me has been the manifest greenness which is now apparent on all the watered parts, which show a much superior color to the adjacent spots which have not been watered, and I am satisfied that this is the most profitable way of applying that which usually goes to waste.

JANUARIUS.

DESTRUCTIVE INSECTS.

From Dr. T. W. Harris's Report on the Insects of Massachusetts.

Cucumber bug.—The pupa state of some species occurs on the leaves—of others, in the ground; and some of the larvæ live also in the ground on the roots of plants. This is probably the case with those of the cucumber beetle. This destructive insect is the *Galeruca vittata*, or striped galeruca, generally known here by the names of striped bug and cucumber bug. It is of a light yellow color, above, with a black head, and a broad black stripe on each wing-cover, the inner edge or suture of which is also black, forming a third narrower stripe down the middle of the back; the abdomen, the greater part of the fore-legs, and the knees and feet of the other legs are black. It is rather less than one fifth of an inch long. Early in the spring it devours the tender leaves of various plants. I have found it often on those of our Aronias, *Amelanchier botryapium* and *ovalis*, and *Pyrus arbutifolia*, towards the end of April. It makes its first appearance, on cucumber, squash, and melon vines about the last of May and first of June, or as soon as the leaves begin to expand; and, as several broods are produced in the course of the summer, it may be found at various times on these plants, till the latter are destroyed by frost. Great numbers of these little beetles may be obtained in the autumn from the flowers of squash and pumpkin vines, of the pollen and germs of which they are very fond. They get into the blossoms as soon as the latter are opened, and are often caught there by the twisting and closing of the top of the flower; and, when they want to make their escape, they are obliged to gnaw a hole through the side of their temporary prison. The females lay their eggs in the ground, and the larvæ probably feed on the roots of plants, but they have hitherto escaped my researches.

Various means have been suggested and tried to prevent the ravages of these striped cucumber beetles, which have become notorious throughout the country for their attacks upon the leaves of the cucumber and squash. Dr. B. S. Barton, of Philadelphia, recommended sprinkling the vines with a mixture of tobacco and red pepper, which he stated to be attended with great benefit. Watering the vines with a solution of one ounce of Glauber's salts in a quart of water, or with tobacco water, an infusion of elder, of walnut leaves, or of hops, has been highly recommended. Mr. Gourgas of Weston, has found no application so useful as ground plaster of Paris; and a writer in the American Farmer, extols the use of charcoal dust. Deane recommended sifting powdered soot upon the plants when they are wet with the morning dew, and others have advised sulphur and Scotch snuff to be applied in the same way. As these insects fly by night as well as by day, and are attracted by lights, lighted splinters of pine knots or of staves or tar barrels, stuck into the ground during the night, around the plants, have been found useful in destroying these beetles. The most effectual preservative both against these insects and the equally destructive black flea-beetles which infest the vines in the spring, consists in covering the young vines with millinet stretched over small wooden frames. Mr. Levi Bartlett, of Warner, N. H., has described a method for making these frames expeditiously and economically, and his directions may be found in the second volume of the New England Farmer, page 305, and in Fessenden's New American Gardener, under the article *Cucumber*.

The cucumber flea-beetle, above mentioned, a little, black, jumping insect, well known for the injury done by it, in the spring, to young cucumber plants, belongs to another family of the Chrysomelian tribe, called *Halticadæ*. The following are the chief peculiarities of the beetles of this family. The body is oval and very convex above; the thorax is short, nearly or quite as wide as the wing-covers behind, and narrowed before; the head is pretty broad; the antennæ are slender, about half the length of the body, and are implanted nearly on the middle of the forehead; the hindmost thighs are very thick, being formed for leaping; hence these insects have been called flea-beetles, and the scientific name *Haltica*, derived from a word signifying to leap, has been applied to them. The surface of the body is smooth, generally polished, and often prettily or brilliantly colored. The claws are very thick at one end, are deeply notched towards the other, and terminate with a long curved and sharp point, which enables the insect to lay hold firmly upon the leaves of the plants on which they live. These beetles eat the leaves of vegetables, preferring especially plants of the cabbage, turnip, mustard, cress, radish, and horse-radish kind, or those, which, in botanical language, are called cruciferous plants, to which they are often exceedingly injurious. The turnip fly, or more properly turnip flea-beetle, is one of these *Halticas*, which lays waste the turnip fields in Europe, devouring the seed leaves of the plants as soon as they appear above the ground, and continuing their ravages upon new crops throughout the summer. It is stated in Young's Annals of Agriculture, that the loss in Devonshire, England, in one season, from the destruction of the turnip crops by this little insect, was estimated at one hundred thousand pounds sterling. Another small flea-beetle is often very injurious to the grape vines in Europe, and a larger species attacks the same plant in this country. The flea-beetles conceal themselves during the winter, in dry places, under stones, in tufts of withered grass, and in chinks of walls. They lay their eggs in the spring, upon the leaves of the plants upon which they feed. The larvæ or young of the smaller kinds, burrow into the leaves, and eat the soft pulpy substance under the skin, form-

ing therein little winding passages, in which they finally complete their transformations. Hence the plants suffer as much from the depredations of the larvæ, as from those of the beetles—a fact that has too often been overlooked. The larvæ of the larger kinds are said to live exposed upon the surface of the leaves which they devour, till they have come to their growth, and to go into the ground, where they are changed to pupæ, and soon afterwards to beetles. The mining larvæ, the only kinds which are known to me from personal examination, are little slender grubs, tapering towards each end, and provided with six legs. They arrive at maturity, turn to pupæ, and then to beetles in a few weeks. Hence there is a constant succession of these insects, in their various states, throughout the summer. The history of the greater part of our Halticas or flea-beetles, is still unknown ; I shall, therefore, only add, to the foregoing general remarks, descriptions of two or three common species, and suggest such remedies as seem to be useful in protecting plants from their ravages.

The most destructive species in this vicinity, is that which attacks the cucumber plant as soon as the latter appears above the ground, eating the seed leaves, and thereby destroying the plant immediately. Supposing this to be an undescribed insect, I formerly named it *Haltica cucumeris*, the cucumber flea-beetle ; but Mr. Say subsequently informed me that it was the *pubescens* of Illiger, so named because it is very slightly pubescent or downy. It is only one sixteenth of an inch long, of a black color, with clay-yellow antennæ and legs, except the hindmost thighs, which are brown. The upper side of the body is covered with punctures which are arranged in rows on the wing-cases ; and there is a deep transverse furrow across the hinder part of the thorax.

The wavy-striped flea-beetle, *Haltica striolata*, may be seen in great abundance on the horse-radish, various kinds of cresses, and on the mustard and turnip, early in May, and indeed at other times throughout the summer. It is very injurious to young plants, destroying their seed leaves as soon as the latter expand. Should it multiply to any extent, it may, in time, become as great a pest as the European turnip flea-beetle, which it closely resembles in its appearance, and in all its habits. Though rather larger than the cucumber flea-beetle, and of a longer oval shape, it is considerably less than one tenth of an inch in length. It is of a polished black color, with a broad, wavy, buff-colored stripe on each wing-cover, and the knees and feet are reddish yellow. Specimens are sometimes found having two buff-yellow spots on each wing-cover, instead of the wavy stripe. These were not known by Fabricus, to be merely varieties of the *striolata*, and accordingly he described them as distinct, under the name of *bipustulata*, the two-spotted.

In England, where the ravages of the turnip flea-beetle have attracted great attention, and have caused many and various experiments to be tried with a view of checking them, it is thought that "the careful and systematic use of lime will obviate, in a great degree, the danger which has been experienced" from this insect. From this and other statements in favor of the use of lime, there is good reason to hope that it will effectually protect plants from the various kinds of flea-beetles, if dusted over them, when wet with dew, in proper season. Watering plants with alkaline solutions, it is said, will kill the insects without injuring the plants. The solution may be made by dissolving one pound of hard soap in twelve gallons of the soap-suds left after washing. This mixture should be applied twice a day with a water-pot. Kollar very highly recommends watering or wetting the leaves of plants with an infusion or tea of wormwood, which prevents the flea-beetles from touching them. Perhaps a decoction of walnut leaves might be equally serviceable. Great numbers of the beetles may be caught by the skilful use of a deep bag-net of muslin, which should be swept over the plants infested by the beetles, after which the latter may be easily destroyed. This net cannot be used with safety to catch the insects on very young plants, on account of the risk of bruising or breaking their tender leaves.

THE SEA DEVIL CAUGHT AT CHARLESTON.

One of the fishing boats in our harbor had a delightful excursion yesterday, without the use of sail or oars. It appears that while the persons in the boat were quietly pursuing their avocation of hooking the finny inhabitants of the deep, off Holmes' wharf, a monster, in the shape of a devil fish, became entangled in the cable by which the boat was anchored, and much to the astonishment of the crew made off with her, taking a direction down the river. Persons on board other boats observing an unusual struggling and splashing in the water, made off to their assistance, and after a hard contest of some hours, (six boats, using some twenty oars, being engaged,) the monster was brought up to town, and became an object of much curiosity, being visited by large crowds. Shortly after reaching the market wharf, it gave birth to a young one, which was landed and placed in one of the stores. The old sea devil measures about fifteen feet from wing to wing, and about sixteen feet in length, being similar in form to the Stingaree. It is supposed to weigh about a ton. The young one is about six feet by five and a half.—*Charleston Courier, 27th April.*

Devil-fish—We have examined the preparation of this enormous beast—which has been made by Mr. R. Waters—and is remarkably well done. Few persons, even here, have ever seen this extraordinary monster, and it is believed to be peculiar to our coast. Take these dimensions for instance—length from mouth to end of tail 16½ feet ; from tips of wings 18 ft. ; of mouth 2 feet 10 inches ; distance between the eyes 5 feet ; weight 3,780 lbs. Among the remarkable peculiarities of structure, may be mentioned the brain, which is small and only protected by the skin of the back—the back bone, which is solid, from the mouth to the tail ; the ribs, so to call them, which hinge in the back bone and run under the skin—about the size of the finger and elastic like whale bone—to the wing—gradually tapering as that recedes to the tail. The general shape is that of a sparrow hawk, with the wings fully extended—wanting the head and tail. The tail of the devil fish is a mere whip-cord. It is provided with a fin on the back, at the tail, which serves for a rudder.

It is not yet settled what this fish feeds on, though it is generally supposed to live by suction, notwithstanding its big mouth. It is armed about the mouth with two fin-like flappers, which are certainly the instruments by which it lays hold of the anchors of boats, &c., though it is by no means certain that they aid it in feeding. On the whole, this may be pronounced the oddest of odd fish, and well worthy of being preserved.

At the north this fish could not fail to attract the wonder of the million, for it is not found in their waters, and differs in a marvellous degree from all the monsters of the ocean.—*Charleston Mercury.*

NEED FOR AGRICULTURAL EXPERIMENTS.—COTTON INSECTS.

Extract from an Address on Agriculture, delivered before the Alabama State Agricultural Society, on 7th Dec. 1841. By the Rev. Dr. Manly.

Experiments for the improvement of agriculture, as they require, when conducted to the best advantage, considerable surplus wealth, much time, patience, and accuracy, and the highest qualities of intelligence ; and as, when successful, they issue in the most momentous results, are worthy the first efforts of genius, and the highest aspirations of patriotism.

No improvements are made without experiments. It is true, they are not absolutely confined to the rich. There is even an advantage, when practical men of limited means, who live by the returns of their labor, can be induced to try them. These will always make them on a plan in which failure will not be injurious, and success will be universally beneficial ; because the poorest may copy out the processes and realize the results. But it is a duty specially incumbent on planters of substantial independence. Some experiments, of course, will be failures ; and such are able to hazard something. The fear of being thought visionary, may deter men from a course of experimenting. And what if the imputation should actually be made ? This is what has happened to every individual who has devoted himself to the enlargement of the boundaries of knowledge. But even visionary schemers are a more deserving class of men than those who will attempt no improvement. For, from the results which they reach, though useless to themselves, wise and practical men will derive important hints ; and thus, incidentally, they do good ; while, as they never set out to get rich, their failure is the less disappointment to them, and they do not need our pity.

I must not be met here, by the inane outcry against " book-farming," and against science as useless to agriculture. I wish not to argue the question on general principles, with this class of objectors. I will advert to facts too stubborn to be overthrown,—to facts, too near the cotton planter's interests and feelings to be disregarded, or overlooked.

Every planter knows something of the depredations of the "*lice*"—the little insect that preys upon the cotton when very young, in the spring. Another familiar enemy is the worm that perforates the boll in August. Either of these is sufficiently injurious alone ; and sometimes they are both, in their seasons, propagated and carried through their transformations in the same field.

Will any planter present consider for himself what average deduction from the cotton crop of Alabama should be made, arising from these two causes ? We know that, in some seasons, the loss amounts to half the crop. And what, in round numbers, is the average market value of the cotton crop of Alabama, unreduced by the depredations of those insects ? The average crop now, is about 300,000 bales ; worth at least $10,500,000. Suppose it diminished one fourth, the average annual loss would then be over $2,600,000. This year has been much less destructive than many years are, perhaps less than the average of years. And yet a single planter of Perry county told me, a few days ago, that in this very year they had destroyed for him, at the least calculation, 400,000 lbs. of seed cotton ; worth $8,000 ! Science, it is true, may cost something, but ignorance costs much more ! We hear much of the burdens of education. But here is a clear annual contribution to *ignorance*, of $8,000 from one man ; and all the planters in the state have contributed in the like proportion.

Science spares the illiberal, the unwilling ; but ignorance, is all-comprehending, inexorable, and resistless.

Now, suppose that any foreign enemy sweeping our coast, or any savage foe lurking on our frontier, should annually levy a contribution, by open force, or secret violence, equal to the depredations of these insects, how would this be entertained ? Although but few persons comparatively were interested, every man in the state would be ready to fly to arms,—the whole power of the general government would be roused to resistance ; and neither land nor sea would furnish hiding-places so remote or obscure, nor fortresses so impregnable, as to shelter the aggressors from merited vengeance. Millions on millions would be lavished, and life profusely devoted, in the patriotic effort to arrest the depredation.

But here is a depredation, that goes on from year to year, " laying taxes without our consent," to an amount not only *indefinite, but absolutely incalculable*, upon the whole body of southern planters, and through them upon the whole union ; and yet the whole body of them, the high-minded and chivalrous, the keen and calculating, the bold, restless, and indomitable together, tamely *pocket* the affront ! The colossal, and almost resistless power of Great Britain could not collect from our feeble colonies in '76, a paltry tax of 3 pence a pound on imported tea, levied without their consent ! But here is the richest production on the face, or in the bowels of the earth, cut off sometimes, by half ; and the richest body of men that ever lived on it, foiled, discomfited, reduced to abject submission, that scarcely thinks of the means of protection, by an insect, a butterfly, a louse, a maggot !

It is already in the minds of some of this audience to say, " This is a providential infliction, and there is no contending against Providence." So are 'briers and thorns' a providential infliction ; but that is no reason why we should not cut them out of our fields. So is sickness a providential infliction ; but that is no reason why we should not seek to prevent and to cure it.

The present state of man is a state of *trial*. As there are many facilities opened up by Providence, for the purpose of trial, not to be used, but avoided; so, there are many obstacles interposed from the same source, not to discourage and thwart us, but to test our ingenuity, resolution, and perseverance in overcoming them. And this is one of them: nor could men be placed in circumstances more favorable for contending with such a foe than the body of southern planters. They have wealth, leisure, and intelligence, and have not been thought deficient in energy. The result to be reached is of such magnitude as should provoke the ambition of the most cultivated, or wealthy. The philanthropist, even, could find no field more fit for the exercise of his high powers.

Were any person possessed of the secret by which in an easy, practicable method, these enemies of the cotton plant might certainly be prevented or dislodged; what might Alabama *afford* to give for such a secret? Millions! millions!

But is it really the case that a remedy for these ills is within the range of science? True science is modest, and does not assume to itself omnipotence, nor even seek favor by boastful pretensions. An answer to that question, however, may be inferred from her achievements in kindred branches of practical knowledge, known and read of all men; and from a view of the nature of the case.

On this subject, as the humble advocate of science, I would content myself with suggesting, that it is possible to capture some of these insects, to keep them supplied, in confinement, with every thing they could find in the fields, to oblige them to carry on all their operations, and pass through all their transformations, under the scrutinizing and unremitted observation of scientific and practical men; who would mark all the phenomena, their periods, their habits, their mode of propagation, their transformations, their winter abodes, and the circumstances which give them influence.

I ask now any plain, common-sense, unlettered farmer, if there is not a glaring probability that such investigations, persevered in, might give the planter a hint by which he could adopt means, at least for the mitigation of the evil, so as to render it comparatively harmless?

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Who will deny the possibility of success, in the instance of the cotton insects? We are sure that ignorance and inactivity will not find a remedy: *perhaps* science may. And the whole cost of the experiment for all time will not amount to the tenth part of what ignorance is now levying upon us, year by year!—It may cost the expense of an experimental farm, with suitable buildings, appurtenances, and apparatus. It may cost the means of engaging the services of some four or five scientific men, skilled in natural history and chemistry; practical, laborious pains-taking men, who will be exclusively devoted to all inquiries affecting agriculture, joined with a communication of a thorough professional education, manual and intellectual, to all classes of our young men, who intend to be planters It may cost this; the setting apart, in a permanent investment, of some $250,000 perhaps, of the people's money, to do what may be styled, if ever any thing on earth could, *the people's own business.*

Could we even suppose it probable that the experiment would fail as a means of extermination of the insects in question, can any reasonable man doubt for a moment what would be the effect on the general interests of agriculture, of such an establishment? A body of able men professionally and exclusively employed in applying the deductions of science to the actual tillage of the soil, to the developement of all its adaptations and resources in every part of the state, to the suggestion and proper trial of every species of improvement in all the productions and arts of husbandry, to the training up, by the union of study and personal labor, of a race of hardy, virtuous, enlightened cultivators of the soil,—the foundation and defence, the bone and sinew, the right eye and arm of the commonwealth?

Gentlemen, it is too plain to admit of a doubt, that such an establishment would, in the course of fifty years, repay to the state in one form or other the cost of the investment, *one hundred times over.* * * * * * * * *

REPORT OF THE CUMBERLAND AGRICULTURAL SOCIETY ON GYPSUM AS MANURE.

To the Editor of the Farmers' Register.

By order of the Cumberland Agricultural Society, at their meeting in November last, the following report is sent to you, with a request that you will give it a place in the Farmers' Register.

Very respectfully, THE COMMITTEE,
BY J. MILLER.

May, 1842.

The committee appointed, by a resolution of the society, to report, "on the benefits of gypsum or plaster, the time, manner, &c., of applying it, to what crops, and on what soils it is most beneficial, and all other information in relation to the subject which they deem important," have had these matters under consideration, and respectfully submit the following report, in part. They say in part, because, as presented to your committee, it is a most fruitful theme, requiring a degree of labor and research which they have not had time to bestow. But such information as they possessed, or have been able to obtain, they freely communicate to the society, as far as they have had opportunity to embody it, feeling very conscious at the same time, that they are communicating little or nothing that is new or valuable; and still more, that they possess no talent for giving to old thoughts a new and pleasing dress. To enter into a formal argument, at this time of day, to maintain the general proposition that plaster of Paris is beneficial to the agriculturist, would prove us a century behind the age in which we live. It is, therefore, presumed that such was not the intention of the society in the reference of this subject to their committee. Assuming this position then as granted, we proceed to the other subjects of inquiry presented by the resolution, not confining ourselves to each in order, but treating them indiscriminately, as they most naturally suggest themselves to our minds, yet, as we trust, intelligibly. Premising that this valuable article can now be procured in our neighborhood, from Stony Point mills to Farmville,

ready ground for use, at $12½ per ton, the farmer taking it away in his own vessels, or at $14 barrelled up, or that it can be got up in the lump, at 9 or 10 dollars, and pounded, (the comparative benefits of which are in a course of experiment by our worthy president, and others near us, the results of whose experience we shall doubtless soon know,) we express it as our opinion that half a bushel or a bushel per acre, prepared in either way, and judiciously applied, is of more benefit to the land and the crop than five times the same quantity of any other manure within our knowledge. To realize all its advantages it must be applied to a clover crop very soon after the removal of the crop of wheat or oats, or the following spring, or both, (February or March is the best time for applying it the second year,) that is, where the clover is the crop for the benefit of which the plaster is used,—or to a clover lay about to be turned in as a manure for some other crop,—or to a coat of vegetable matter or coarse manure about to be ploughed in for the same purpose,—or on checks or drills of manure, especially of coarse manure, on which you are about to hill or bed the land for a crop. The application of it first recommended would, we are persuaded, save many a field of young clover which perishes, in dry seasons, from its sudden exposure to the hot summer sun, after the removal of the crop of small grain which had protected it during the earlier part of the season. We regret that we have no experience of our own to adduce on this branch of our subject; but we learn through one of our body, in habits of intercourse with the farmers on James river, below Richmond and Petersburg, that such is the practice with some of them, and with marked improvement of the clover and the land. We add that, admitting its benefit to clover at all, (on which surely we are all agreed,) this conclusion, we should think, would address itself at once to the understanding, too powerfully to be resisted. A practical farmer, of no ordinary merit, in an adjoining county, mixes his plaster with his clover seed when sowing, in the proportion of a bushel of the former to a gallon of the latter, with the same result. A question has been started whether its application to wheat at that stage, may not increase its tendency to rust. We merely throw out the idea to set wiser heads to thinking, without expressing an opinion upon it. If aught, however, which may add to the sap of the wheat, when there is danger of redundancy, and consequent danger of rust, should be avoided, then it is worthy of some consideration, especially when the wheat crop has, for years, been so precarious, and more perhaps from rust than any other cause. And if the clover and the land can get the full benefit, and an injury to the wheat be avoided at the same time by sowing the plaster after harvest, rather than with the clover seed, certainly it should be done.*

2dly. On clover the second spring. This being the universal and approved practice, where clover is plastered at all, it needs but a passing remark or two. In vain do we sow plaster, if we tread or graze our clover the same winter or spring. Not a hoof should go on it after November. Nay, we doubt whether, if it could be avoided, our young clover should be grazed at all. But we will glean our fields of the scattered wheat and oats; and it would be darting straws against the wind to argue against it. Some judicious James river farmers, it is true, recommend that it should be grazed the first summer and fall to cleanse it of weeds, especially the stick weed. It is very questionable, however, in the opinion of your committee, whether, upon our drier lands this should be done, except, as before intimated, it will be very sure to be done "right or wrong." But when we have gleaned our fields, if we would preserve our clover, or profit by it, and at any event by or after November we must provide pasturage for our stock elsewhere. But what, it may be asked, has this to do with plaster? Much every way. We are required to report on the time and manner of applying it. We answer, in this connexion, sow it on young clover in the spring, not trodden or grazed since the preceding November, for a crop of clover. If you first lighten the soil with a thin, sharp coulter, (supposing it at all close,) you would perhaps do well. February is the best month for applying the plaster; March will do, but not as well.

3rdly. Apply it, half to one bushel per acre, to a clover lay, to turn in for the benefit of some other crop. Many planters, it is believed, keep up their tobacco lots in this way, without deterioration, with a rotation of tobacco, wheat and clover. This, in a tobacco district, is perhaps the most profitable use to which plaster can be applied: and in the spring for tobacco, as late as April, or even May; for corn, as late as March, or 1st of April. In one instance known to your committee the present year, a clover lot was thus prepared for tobacco as late as the 21st of June; and the crop compares advantageously with lots highly manured from the stable and farm-pen. In another instance, where a luxuriant growth of clover was turned in late in February and early in March, without the second plastering, but well plastered the spring preceding, a very heavy crop of tobacco, and of superior quality, is the result. The land has undergone a pretty severe course of cropping since it was cleared, some 9 years ago, viz.: three crops of tobacco, then wheat, clover and tobacco twice; and has been fully kept up to its original fertility, if not improved, by this system of clovering and plastering. Nay, it is believed that the tobacco crop on it this year is the best it has ever produced. These, with many other instances which might be adduced, within our own experience and observation, as well as upon the information of others, convince us that the spring fallowing of clover land, intended for a hoe crop, is better than fall fallowing. But if the planter has more of it than he can do in the spring, or deems it unsafe to defer so much of his ploughing to such a late period, his clover lots intended for tobacco, at least, should be broken up in the spring, with the previous dressing of plaster recommended. The second instance, above referred to, goes far to prove the continuing be-

* Since the foregoing part of this report was written we have conversed with an intelligent planter and farmer of this society who insists that the chief danger to the young clover arises from the great draught on the land by the wheat crop from April to the time of its maturing, and that therefore the best time to sow plaster to obviate if is in April. And, in the single instance in which he tried it, he thought the clover greatly benefited, and that the wheat received no injury.

nefit of the plaster after the first year; and is only one of many going to establish the same fact and giving us assurance that its advantages are not limited to a single year, or single crop, but that, directly or indirectly, it imparts additional fertility to the land for years.

4thly. Apply it in the same mode and quantity to any coat of vegetable matter, or coarse manure to be turned in for a hoe crop. As facts speak louder than mere speculation, we state that one of your committee, some years ago, sowed plaster on half rotted wheat straw, with which he manured part of a tobacco lot, and gave the remainder of the lot about the ordinary coat of farm-pen and stable manure, without plaster, the advantages of the different parts being, in all other respects, about equal. The plastered part was the best tobacco. The peculiarities of the season are not now recollected. He would, by no means, recommend this example to the imitation of his brother planters: it was a last resort in his case, his better manures being exhausted. But what would probably have been the effect of plastering the whole?

Another of your committee, in the year 1836, cleared up a piece of old-field pine land, set with broom-straw, and other coarse grasses and weeds, and partially covered with pine leaves. The land was very poor. He took off only the wood, and such coarse litter as could not be ploughed in, sowed plaster in the spring, ploughed it in, and planted corn. The crop was a fine one for the land, not less than 6 bushels to the acre—while a part of the same land, left unplastered for the sake of the comparison, yielded only 2½ bushels to the acre. The same land now, from the use of plaster and clover, yields 3 or 4 barrels to the acre.

Another member of your committee sowed half a bushel of plaster per acre, on part of a tobacco lot late in April, which had been covered in February by a heavy manuring on clover; on another part, having twice the quantity of manure, but no clover, 1½ bushels. The clovered part made the best tobacco.

5thly. It would seem almost superfluous to say that if plaster acts so kindly sown broadcast on such manures, it must act, with no less effects, on hills or drills of the same. This perhaps may be the more economical way of using it, viz.: checking the land, where to be applied in the hill, and depositing the manure and a table-spoonful or two of plaster in the check, and hilling on the check. Where to be drilled, make a small furrow, deposite the manure, sow the plaster on it, (as much per acre would be required in this way, perhaps, as sowing broad-cast,) and bed the land upon the drill. A very judicious cultivator, a member of this society, being asked by one of your committee, how his tobacco came to be better than most of his neighbors', on land apparently as good, and as well manured? What secret he had, if any, in the preparation or application of his manure? Replied that he had none, unless it was that he drilled his manure altogether, and that not in furrows, but upon the slightest perceptible line, or mark made with a trowel-hoe, the ground being first well prepared; the advantage of which, he said, was to bring the manure sooner to the nourishment of the young plants, at the very stage that they most need it. He was not asked, whether he plasters those drills of manure. Most probably he does, as he uses the article to some extent. But whether he does or not, it would no doubt improve the crop, as well by bringing the manure sooner into action, as by its own magic influence, and perhaps the crop of small grain to follow, and the land.*

6thly. Rolling seed-corn in plaster, or putting a little in the hill when dropping the corn, sowing it lightly on tobacco plants, in the bed or patch, especially when they appear faded or sickly, on plants in the hill at almost any stage, but especially just after trimming down, and just on the eve of a rain, if you can so time it, and soon after topping, are modes of using it with which, it is presumed, most planters are familiar, and the advantages of which they generally appreciate.

7thly. It is recommended by respectable authority, known to the committee, and by Liebig, in his "Organic Chemistry," to use it in the stable, farm-pen and manure bank, by mixing a small quantity with the contents of the stalls, pen or bank, to which it is said to give much greater activity. While we have no experience on this subject, this use of plaster commends itself so powerfully to our reason, and is attended with so little trouble and expense, that we think the experiment worth trying.

On the question "to what soils it is adapted?" we would say that, in our judgment, it is as well adapted to the soil of Cumberland as any whatever. On light, gray land, the general character of ours, where it has not been worn out, with the least mixture of vegetable matter, it acts like a charm. And even where such land is pretty well exhausted, if it has a tolerable subsoil, it is perhaps more easily resuscitated than any other, by the judicious use of clover, plaster and manure. The red lands, stony lands, stiff low-grounds, and creek and branch flats, generally of vegetable mould, or made earth, as we say in common parlance, and even pipe-clay lands, which form the exceptions to the general character of our soil, admit of the most profitable use of plaster. It tells on clover, especially, grown upon red land, as decidedly as on any other. An opinion is prevalent with many, that it does not act kindly on what we call pipe-clay lands, and perhaps it does not as much so as on others. But we are persuaded, that where it has failed of a happy effect on such, or on any, it has been more owing to the land not being well drained, or destitute of any vegetable matter to help it along, if we may so speak, than to any natural incongruity between the land and the plaster. It will not act on a mere caput mortuum, (naked clay) or on sobbed land, however well supplied with vegetable matter. But very striking effects from it are seen on well drained low-grounds of this very kind. The James river bottoms, for example, have generally the subsoil, which gives

* Since writing the above, one of your committee has seen a gentleman who manures for tobacco in this way, *including the plaster*, and who says that the result is superior to that arising from nearly double the quantity of manure spread in the usual way and ploughed in. It cannot admit of any question, however, that the latter would be better for the crops of wheat and clover to follow.

this designation to land. Yet where shall we look for more wonderful results, wrought by the judicious use of plaster? On all lands, then, we would say that it acts beneficially, with the proper accompaniments; and that the Cumberland agriculturist, especially, has great encouragement to try it. And so of crops, the difficulty, in the opinion of your committee, would be to say what it will not benefit, from our most valuable staples, down to the smallest garden vegetable or flower. But its adaptation to clover has been probably the best tested, and its continued application to that crop is yet, we trust, to produce the most marked results, in reclaiming our exhausted, and preserving our rich lands. To other grasses, to corn, wheat, tobacco, oats and peas, it may doubtless be applied, if not with equal, with very encouraging success. All which is respectfully submitted by your committee.

AGRICULTURAL CONDITION OF PENNSYLVANIA.

Extract from the Transactions of the New York State Agricultural Society.

Pennsylvania, in a geological sense, is characterized by a division of secondary and transition formation, excepting a small portion of primitive, in the southeast end of the state. Some geologists contend that we have no well defined primary rock, in the whole state.

While the population continued more sparse, it was not uncommon to see large portions of thin soil run over by the French pioneer system: which, failing to produce on their depleting plan, after a series of crops, was thrown out as commons, or old field. It is matter of interest now, with a more dense population, to see those commons enclosed, and made productive, chiefly by the free use of lime. This manure, being spread on the surface, has sufficient specific gravity to work in; after one or two years, the ground is cultivated, and a rotation of crops commenced. Lime, on these soils, is so effective, that the farmers count on an extra bushel of corn for every bushel of lime. Here I allude, of course, to the poor lands, destitute of carbonate of lime and the constituents of the cereal grains.

The farmers of New-York may form some idea of the use made of lime here, as a manure, when I state that I burn at my own kilns, only three in number, containing from ten to fourteen hundred bushels each, about 40,000 bushels in a year, and there are in the neighborhood some half dozen persons who burn a like quantity; some of which is hauled more than thirty miles, into the southwest of Chester county, and to Cecil county, Maryland. Lime is usually applied, at a rate from thirty to fifty bushels on poor lands, and from sixty to one hundred bushels, on good limestone land. The former practice, of spreading it fresh, in its caustic state, on ploughed ground, preparatory to planting or sowing, is fast giving way to the plan of throwing it in conical piles, to slake and carbonate, after which it is spread on the sod, as a top dressing for permanent pastures, or to lie a year or two, before the ground is ploughed. Lime at the kilns here, is sold at ten to eleven cents per bushel, and as high as twenty-six and eight cents, delivered thirty miles. The value of our first rate land in this county, may be stated from $100 to $120 per acre, according to the value of improvements, convenience, water, &c.

In Pennsylvania, it may be said there are three different systems of husbandry practised.

1st. The cropping system; the usual custom is, to plough a sod field, in the fall or spring, for corn, which is cut up at the ground, following crop oats or barley, then manured and put in wheat; after which it is put down to grass, generally clover, without and with timothy. Clover fields are usually ploughed and sowed in wheat, and make the most certain crop; the following crop, if manured, wheat, and if not, sowed in rye and seeded down to grass. This system is the most laborious, hence it is uniformly adopted by the German farmers, on our best lands.

2d. A mixed system. This system is being adopted in some sections, suitable for it. A portion of the farm is set apart, well watered for permanent pasture, which receives a triennial top dressing of lime, compost, or short manure. Green grass (Poa viridis) naturally obtains, on our strong, calcareous soils, when not broken up by culture, and is decidedly the best grass for fattening. The balance of the farm is conducted, in all respects, as stated in the first named system. This plan I consider *best*, and of course adopt it on my own farm.

3d. This is called the grazing system, and is uniformly adopted, in the eastern counties, near Philadelphia, for dairy purposes and feeding off cattle for the shambles. There is very little farming or ploughing done in this system; merely enough grain raised for the consumption of the family and stock; balance of the whole farm is appropriated to pasture, and hay. Few horses are kept, where this system prevails, oxen being substituted, on the score of economy and profit.

In some of the extreme western counties, stock raising is made the principal business, particularly in Green and Mercer counties, the soil there being adapted to grass. The stock, cattle and sheep are driven east, and sold in Lancaster and Chester counties, to be fed off.

Western Pennsylvania is rapidly improving in agricultural products; raising, according to the late census, about 2,000,000 bushels more wheat in a year than eastern Pennsylvania; the extent of wheat land being far greater west, than east of the mountains. Western Pennsylvania was formerly poorly cultivated, but is now rapidly improving and will far excel us, here, in the eastern part. While we, here, are confined to the Philadelphia market, they of the west have the choice of Philadelphia, Baltimore and Pittsburg, by canal and railway, while the Ohio and Mississippi bear away much of their surplus produce to New-Orleans.

Beet and turnip culture was commenced in this state with considerable spirit, but few continue now to advocate root culture, further than potatoes; like, *and indeed* not unlike, the multicaulis mania, our shrewd and more discriminating farmers allege that both have proved to them, like "faith without works." Draining and reclaiming bogs and swamps, afford another resource, to us, which our

forefathers overlooked, which we find best performed by operatives fresh from the Emerald Isle.

REPORT TO THE STATE BOARD OF AGRICULTURE,

ON THE BRANDON FARMS.

By Edmund Ruffin.

General description of the alluvial and low lands of a part of James river.—The low-grounds or alluvial lands on the tide-water of James river are of two distinct kinds, and both of them very different from what are usually called "low-grounds" on that and other rivers and smaller streams above tide. In all the latter cases, great as is the diversity of soils and their conditions, there would always be understood to be a general agreement in these characters: soils having been formed by the deposites of overflowing freshets, to which the lands are still more or less subject—being wet enough generally to need draining, on account of springs, as well as of inundation—and rich and well constituted as to their earthy, as well as alimentary ingredients. The low or alluvial lands of the tide water of James river, especially from Curles Neck, in Henrico, to Jamestown island in James City county, inclusive, are either of *recent* or of *ancient* alluvial formation. The *recent* alluvial, are the marshes, still subject to be covered by tides, either of common or uncommon height. These lands contain scarcely any silicious sand, and their only earthy ingredients are such as would remain long suspended in slowly moving waters, and subside slowly where the water was still, or the least agitated. Of course, this deposite is still and continually going on, and will continue as long as fine earthy and putrescent matters are washed from the higher country, and brought down by the river. Half the weight and perhaps nine-tenths of the bulk of such soils consist of vegetable matter. But as rich as they are, even the highest of these lands are worth nothing for tillage, and scarcely any thing for grass and pasturage, unless embanked from the tide as well as being drained. And when so embanked, and made dry enough for tillage, the vegetable and putrescent matter, and of course much the larger portion of the soil, run quickly into decomposition, (from which they were protected before, by being continually covered by or saturated with water,) and the land actually *rots away*, until its surface has been reduced so low, that it has became again too wet for cultivation, or even for good grass; when the wetness will again protect the remaining soil from further waste. All the many and very expensive improvements of such lands, by embanking and draining, after a few years of luxuriant and heavy products under tillage, have been lost, and the lands have become again, as at first, worthless for agricultural purposes; and, by loss of their former height, and of their previous fine growth of trees, (if the land had been high enough to bear trees,) these embanked lands, when again yielded to the dominion of the tides, are greater nuisances than before. There is scarcely an estate having such land attached, which would not be made more valuable by the total removal of the marsh. And if all the tide-marshes on the river and its creeks could be sunk twenty feet below the lowest tide, it would be almost as great a blessing to the proprietors, and to the neighboring residents, as would be the draining of all the mill ponds. The marshes, however, as a source of disease, bad as they may be, are exceeded in that respect by the mill ponds. Of course, the river farmers rarely derive any substantial benefit from these marshes, to counterbalance their ill effects.

The only other kind of what may be considered as low-grounds are also manifestly of alluvial formation, but of a time very remote, and when the waters which deposited these lands had an elevation, a volume, and degree of rapidity and power, very far exceeding those of the river now. Generally, where the lands (other than marshes) do not exceed 20 feet in perpendicular elevation above high tide, and are moderately level, they are of this ancient alluvial formation. They are scattered at intervals along both sides of the river, but much the larger part on the northern side, in detached pieces, varying in size from less than 100 to several thousands of acres together. Such lands were at first among the richest of lower Virginia, and for their valuable qualities and general advantages are still among the most desirable farming lands in our country. The well known and valuable farms of Curles Neck, Shirley, Eppes' Island, Berkeley, Westover, Weyanoke, Sandy Point, and Jamestown Island, on the north side of James river, and of small parts of Jordan's Point, Flower-de-Hundred, and all Brandon, on the south side, as well as other tracts less known to the writer, are of this particular formation and character. And though varying greatly, in many respects, they all possess a general uniformity of aspect and of quality, which distinguish them from all other neighboring lands. These general remarks are but prefatory to the particular subject of this report, which will be the two Brandon estates, in Prince George county.

The Brandon lands.—Brandon *Neck*, (the old and still usual name for all bodies of land thus stretching out into the river,) is a broad and low-lying peninsula, formed by James river and Chapokes creek, and contains several thousand acres of land, distinctly marked from the very poor and high table lands, that lie immediately adjoining. The whole "neck" embraces not only the two estates of Upper and Lower Brandon, which alone will form the particular subject of this report, but also two smaller farms adjacent, of inferior soil, and to which no farther reference need be here made. Thus the name *Brandon* has several different applications, which should be borne in mind, to prevent confusion. The whole peninsula is called Brandon *Neck*. Brandon, simply, was the one estate formerly held by Benjamin Harrison, and which, after his decease, being divided between his two sons, George E. Harrison and William B. Harrison, the two separate properties are now known, the former as Lower Brandon and the latter as Upper Brandon. The terms lower and upper have no reference to the elevation of the surface, but merely to the relative position of the lands in regard to the river. These two estates are each divided into two separate farms; and

the four farms together take in much the greater and also the most fertile part of the whole peninsula.

The Brandon lands have the same features that distinguish all the *ancient* alluvial lands of James river in general. The surface is abundantly level, yet not entirely so any where; but gently undulating, so as to be almost every where quite free from the usual evil of rich low lands, excess of water, from which these lands would have been mostly free, even without any draining. But still there was much that required draining, and which, by that mode of improvement, has been rendered as dry as the higher part. The surface of the land is in the form of many low and long knolls or broad ridges, gently sinking at their sides and terminations, and separated from each other by shallow and narrow depressions. These depressions, for want of sufficient outlets, were originally ponds, covered with still and nearly stagnant collections of rain water, either during part or all of the year. But there was very little of spring water, or other than surface or rain water, to be removed, and of course the draining was easy and effective.

The soil in general is a reddish-brown loam, well known by the provincial term "mulatto land." The soil is deep, and the sub-soil so little different from the soil in general appearance, that it may well be supposed to have been of the same formation by deposite from the same originally overflowing waters. The texture of the soil varies, in different parts, from clay loam to very sandy and light loam. But, as all know who are acquainted with "mulatto soil," the stiffest is not too stiff and intractable for easy cultivation, or too close for the profitable growth of corn; and the most sandy, if properly constituted otherwise, is not too light and open for wheat or clover. The peculiar value of "mulatto land," and which value belongs to all the tracts named above as of ancient alluvial formation, must be owing to a happy combination of lime and oxide of iron, with the other ordinary ingredients of the soil. All these lands, like Brandon, were doubtless originally very rich; and though since greatly worn and exhausted, and reduced low in product, can be easily brought back, by judicious management, to a high state of fertility. There is no *carbonate* of lime in these soils, however, (which deficiency is almost universal in eastern Virginia,) but the lime in some other form of combination must be in sufficient quantity to give to the soil the power to combine with and retain putrescent manures —to produce clover to some extent and profit— and to receive benefit to clover from gypsum; neither of which three qualities belong to any of the naturally poor lands of the tide-water region of Virginia. On the other hand, there was not enough lime naturally, in the Brandon and other similar soils, to forbid the growth of sheep-sorrel, (*rumex acetocella*,) and poverty grass, (*aristida gracilis*,) when reduced to poverty, nor to prevent there being produced great and marked improvement when more lime is given to the soil. Indeed, it is almost exclusively on this kind of land that have been made the great improvements by liming, and by clover and gypsum in connexion with and after liming, on the lower James river. There is no reason, in the character of the soil, why the use of lime should have been so far almost confined to these lands. But there were two other reasons why the use should have been first commenced there, and the improvement prosecuted with more vigor than elsewhere. The first reason was, that these lands are altogether deprived of marl, which is so generally in abundance under the hilly or high and poor lands adjacent. In the second place, these fine lands were mostly held by wealthy and intelligent farmers, and such are more capable of appreciating proposed improvements, and more able and ready to execute them.

The former ponds, though having now been for a long time as dry and as regularly and as well cultivated as the originally dry intervals, are altogether of different soil. They are of a whitish gray clay, extremely intractable and difficult to pulverize and to keep in good tilth. Notwithstanding all the greater labor and more manure bestowed on these places, they are still easily distinguishable when ploughed, wherever seen, and exhibit a manifest difference in color, as well as inferiority in texture and in product.

For the foregoing general remarks, and for any errors therein, the reporter is solely responsible. In the following statements and details of facts, and the opinions expressed thereupon, he had the benefit of the careful and well weighed information of Mr. W. B. Harrison, the proprietor of the Upper Brandon estate, in answer to particular inquiries made in person, and in free conversation. The inquires were directed generally and more especially to the subjects indicated in the circular of the Board of Agriculture; and the answers of Mr. Harrison, in regard to the Lower Brandon estate, were all concurred in by his nephew, Mr. George Taylor, the administrator of the estate, who resides there, and the investigation was aided by his more particular acquaintance with the minute details.

Where the answers or statements are general, or not specially applied to any one locality, it will be intended to suit the two estates in general. When it is proper to distinguish between different parts, the distinction will be made. The statements will be arranged under separate and appropriate heads; but the consideration of some subjects will necessarily be somewhat intermingled with others; and therefore strict regard to method and general arrangement will sometimes be made to give way to convenience for description.

After a long course of exhausting and generally injudicious cultivation of the two Brandon estates, during the minority of these proprietors, the elder, George E. Harrison, whose lamented death occurred in 1839, came of age, and took charge of his share, Lower Brandon, in 1817, and William B. Harrison two years later. Both these gentlemen have been, from the outset, devoted, judicious and enlightened farmers; and on few estates, if any in Virginia, has there been more of valuable and productive improvement made, accompanied by securing of good and increasing annual profits. The untimely death of George E. Harrison did not, as is usual in such cases, put a stop to the then well advanced progress of improvement on his estate. His property was placed, and has since continued, under the general supervision and controlling advice of his younger brother; and the same mind and spirit, with equal zeal and energy, have since

animated and directed the whole procedure on both the estates. From their contiguity, their similarity of character and of management, the two estates, large as they are, may be properly and conveniently treated of as one subject, as will be done in this report. The elder brother had lost no time, and of course led the way in the work of improvement. His whole course of operations was judicious and admirable, and highly successful. Still he was cautious, and slow in some of the measures, especially in the main one, liming, compared to the later and better assured subsequent operations of his younger brother.

When the reporter recently looked over the Brandon estates, and with more care than on former occasions, for the purpose of preparing this report, there was one thing that frequently occurred to his observation. This was, that every particular operation was directed with a strict view to economy, so that it should yield the greatest possible profit; and as there are necessarily many more things to be done than can be effected, the most desirable and profitable are chosen to be executed, and are well performed, and the less profitable are entirely neglected. There seemed to be nothing done (of farming operations proper) merely for better appearance. Where the land was rich and well tilled, the crops heavy, and every thing essential thereto well attended to, there was necessarily to be seen, in perfection, the more prominent features of the beautiful as well as the useful of agriculture. But at the same time, the less important matters neglected, because something must be neglected, (but which a martinet farmer would have removed, though perhaps at greater loss than profit,) often caused apparent defects, which some persons might deem too great to be thus justified, and even approved, as parts of the whole management. Still, whatever of such deficiencies may there exist—showing that, as much as had been done towards perfection, much still was wanting—there was no reason to believe that the choice had not been judiciously made, both of the objects to be most cared for, and those to be attended to less, or not at all. Neater tillage may be seen elsewhere, in regard to the smaller accompaniments and finishing; and where there is less to do for the force employed, there may be fewer defects of omission in general. But, for so wide a field of operation, and for the means and force for operating, it may well be doubted whether there is any where a more profitable direction of effort than on Brandon.

Extent.—The estate belonging to Wm. B. Harrison is cultivated as two separate farms. Of these, Upper Brandon farm, (the residence of the proprietor,) has 780 acres of arable land, cultivated in turn; and no separate pasture, except Kennon's marsh, forming a point in the river of 1000 acres in extent, but of which only the margin joining with the high-land, is of any use for grazing. The great body, as of low marshes in general, is so miry as to be unsafe for cattle, and the rank cover, of sedge and other coarse water grasses, of no value for their food.

The other farm, Upper Quarter, has 650 acres of arable land, and 130 more of pasture. The pasture is of newly cleared land, and has been sown, and is partly set, in herds-grass. The only other use made of it is occasionally to sow parts successively in oats. 400 acres of wood-land are attached to the upper estate.

The estate of George E. Harrison, deceased, consists of the mansion house farm, called Lower Brandon, of 865 acres of arable land; and the Church Pastures farm, including Dandridges (purchased) 950 acres, and 30 acres of pasture land. A very large body of wood-land belongs to the lower estate—much more than is of any use. More distant, there is also a great deal of very poor forest land, which merely serves to supply building timber, and some part of the material for fencing.

Soil.—More than five-sixths of all the arable land of the two estates, taken together, is mulatto loam—varying in different parts from light to stiff loam. The sub-soil generally very similar to, but more clayey than, the soil above.

Rotation of crops.—On Lower Brandon and Church Pastures farms, the rotation is the same, of four fields; and the course of crops, on each field, is 1st year, corn, 2d, wheat, 3d, clover, and 4th, on more than half the field, wheat on clover fallow, and the remainder in clover and grazed. That part of the field of the fourth year which is not grazed, and the clover ploughed under for wheat, is selected so as to be the most convenient and suitable for the purpose.

Upper Brandon farm—in the four-field rotation of 1st, corn, 2d, wheat, 3d, clover, fallowed for 4th, wheat—except that a low and very light field of 100 acres (too light for good wheat) has heretofore been kept in a two-shift rotation, of 1st corn, 2d, at rest; but is now put under a three-shift rotation, of 1st, corn, 2d, oats, and 3d, clover, not grazed.

The Upper Quarter farm, is cultivated in the three-field rotation, of 1st, corn, 2d, wheat, 3d, clover. No grazing on either farm or field of the upper estate, except on the recently reaped wheat fields and their young clover as soon as the wheat has been taken off to be thrashed; and the older clover fields late in the year after August, if to be ploughed for wheat; or September, and later, if for corn the next year. No grazing close permitted at any time.

Thus, on the four farms, there are four schemes of rotation differing more or less from each other; there being one kind for the two farms of the lower estate, two other kinds for the two farms of the upper estate, and one other kind for the light field of 100 acres attached to Upper Brandon farm. These differences have been prescribed in part by the difference of circumstances, and there being no separate pasture land on one of the two farms of the lower estate, and but 30 acres on the other; and on the upper estate the different courses were required by the difference of soil of the several farms. The Upper Quarter is more generally of light loam, better suited to corn than to wheat. The Upper Brandon farm, generally, more clayey and stiff than the other, and better soil for wheat than for corn; though the soils of both farms are no where so light or so stiff as not to be enough suitable for both wheat and corn. But, the low light field of 100 acres, though part of the Upper Brandon tract, is a very fine corn and oat soil, and nothing like equally suitable for wheat.

Preparation for and cultivation of corn.—The lands designed for the corn fields are in several different states, according to the different rotations.

On Lower Brandon and Church Pastures farms, part of the fields for corn is of clover of the third year, grazed, and part on wheat stubble. On Upper Brandon farm, it is wholly on wheat stubble, except on the light 100 acre field, which when for corn, and also the Upper Quarter shift, is in clover of the second year and best growth, grazed late only in the second year, and not so closely but that there is still a heavy cover of the remaining clover to be ploughed under.

Preparation for and cultivation of corn.—The land for corn, of either kind, is broken up with good three-horse (or mule) ploughs, cutting from 6 to 8 inches deep. This is begun in November, and each field usually finished early in winter. The dry parts of the field are ploughed flush, (or with a flat surface,) and wherever the least inclined to be wet, in ten-feet beds. The manure from the farm-yard and stables is carried out afterwards when convenient, and ploughed in with two-horse ploughs. During the spring, the lime is put out on part of the same field; and if it be a second application, it is put to the part manured. The balance of the land, not manured, is harrowed in the spring, and once harrowing generally serves to put the ground in good order.

The flushed part is laid off for planting in checks of 5 feet by 4½. The time in which the planting is desired to be commenced and completed is between the 5th and 25th of April. From 6 to 8, and even 10 grains of corn planted at each station. It is deemed economical to give so much excess of seed, to have the fewer missing places, and the less replanting. The corn at proper time is thinned to two stalks to the station.

The first ploughing, given soon after the corn is well up, is in the direction of the wider rows (5 feet) and with two-horse mould-board ploughs turning one furrow slice from each side of the corn-row. The next ploughing is across the preceding, and generally done with double-shovel ploughs, (two-horse,) going twice to the interval between each two corn rows, which breaks the whole interval. Mr. Harrison ascribes much benefit to his practice of giving early and frequent ploughings; and would prefer to repeat the ploughings as often as every 15 days, until the tillage be completed. He usually gives four ploughings (each time crossing the last,) with the double-shovel ploughs; the last of which is begun immediately after the wheat harvest is finished, and on the lightest and most forward land sometimes before harvest. The weeding with hand-hoes is commenced after the second ploughing. A second hand-hoe weeding is given to the foul spots only.

On the land thrown into ten-feet beds, there are two corn-rows planted on each bed 5 feet apart; and the first ploughing is given as above, by turning off one furrow from each side of each row. Next, the double-shovel ploughs are used to finish the interval which is on the top of the bed, (or including in it the crown of the ridge,) and one-horse turning ploughs to plough the water-furrow intervals, throwing the slices outward from the water-furrow. The hand-hoes follow, weeding the corn and putting a little earth to the plants. These operations are repeated as wanted, and four or five such ploughings are given in all. The blades (or leaves,) of the corn are pulled off and the tops cut, as usual for fodder; and no important injury to the grain is supposed to be thereby caused; care however is taken that the operation is at the proper time—not early enough (as supposed) to damage the corn, and not so late that the fodder has become much injured by decay.

Upon expressing surprise at so much tillage labor being used, in comparison with the usage of many other successful farmers, Mr. Harrison readily admitted the greater cost of his corn culture; but maintained that the additional labor was well paid for in additional product. He had tried the cheap modes of cultivation recommended, and had even succeeded in making what would have been admitted to be very good corn with less than half his number of ploughings, and without using hand-hoes at all for weeding. Nevertheless, he is sure that more work would have made a better crop, and that his now usual additional labor would have been well compensated.

Wheat.—The turning in of the clover (which has been neither grazed nor mown,) is commenced early in August, and sometimes late in July, forming fifteen-feet beds with four-horse ploughs, on the level surface; and with three-horse ploughs ploughing on ten-feet beds – *reversing* the latter, or making the crown of the new bed, by lapping the first slices, upon the former water-furrow, and making the new water-furrows under the places of the old crowns. The ploughing in both cases is from 6 to 8 inches deep, or as deep as the teams can well draw at that usually dry season, and turning under the fall growth of clover. Linked or coupled square harrows, which accommodate their cutting surface to the uneven and varying face of the ground, are passed over soon after the ploughs, to close the seams between the slices. The like harrowing is repeated occasionally afterwards, as required for the good condition of the fallow, and even the double-shovel ploughs are used on the most grassy spots.

The seed wheat is selected carefully, thrashed the earliest of the crop, and then put away dry. The sowing is commenced about the 8th of October. The seed is prepared by being poured slowly and gradually into a vessel of water, stirred, and all the floating grains, and all impurities light enough to float, are skimmed off. The wheat is then drained, sprinkled with and rolled in fresh slaked lime. This process is believed to be an effectual safeguard against the smut. The sowing is pushed on as fast as possible, beginning on the corn-land. The corn, on the stalk, is cut off at the ground, and set up in shocks, as usual, on the wheat, rows being kept sown a little in advance of the general seeding, to set the shocks upon. The corn-land is ploughed with two-horse ploughs, the wheat then sown, and harrowed in, by passing over the coupled harrows twice, or oftener if required. The usual quantity of seed to the acre is 1½ bushels, if of the purple straw wheat, and nearly two bushels if of the larger grained turkey wheat. On the clover fallow, rather more than 1½ bushels of purple straw is sown, or full 2 bushels of turkey wheat. The latter variety is preferred for cold or stiff soils—but the purple straw is better for all other soils, and in general. The latter has been sown at Brandon and preferred for the last 15 years.

On this subject, Mr. Harrison has expressed

his opinion more fully in a private letter, subsequently received by the reporter, and which passage he will make free to quote here.

"In regard to seed wheat, not recollecting distinctly what my answers were, I would say that I greatly prefer the mountain purple straw to any other variety I have ever tried on our lands. It generally maintains its superiority here from seed time to harvest, over every other kind. There is less seed required, from the smallness of the grain, and I have observed that it generally comes up better than any other sort tried here. Although it grows very tall, my observation is that it stands better during its growth, and also in a protracted harvest, than any wheat known to me, and that there is less loss incurred in securing it. I do not doubt, however, the peculiar adaptation of particular wheats to particular soils; and on some of my own lands even, I prefer the culture of other kinds, and particularly when, from the tenacity and humidity of the soil, there is any danger of the smut. The turkey wheat is well suited to such places. Having said so much in favor of the purple straw, I must, on the other hand, admit that it is very subject to injury from the fly.

"With regard to continuing the same kind of wheat, from seed raised on the farm, without deterioration, I incline strongly to the opinion that it may be done by great care in selecting seed; which is a very important matter, and should be strictly attended to. It is said to be an excellent plan to select the earliest and finest heads, and to keep it pure in that way."

On the 15th of October, the sowing on the clover fallows is begun—believing that then commences the best and very limited time for sowing. It is important to get as much seed in the ground as possible in the next 10 or 12 days—and the facilities for much the most rapid operations are offered on the clover fallow. Double-shovel ploughs are there used to get in the seed, followed by harrows. The water-furrows are every where cleared out well by the passage of a suitable (double mould-board) plough, and cross furrows and grips (small, narrow and shallow ditches,) opened wherever needed in low places where the rain water would otherwise collect and stand in the water-furrows, to the injury of the crop.

Of late, the wheat seeding operations have been usually completed early in November; and immediately after they are done, the ploughs proceed to break up the land for the next crop of corn, which it is important to begin thus early, for the purpose of forwarding all the operations of the season. The great body of the field for corn is wholly ploughed before Christmas, or soon after. The land remains softer for being ploughed thus early, (turning under a good cover of wheat stubble or of clover in most cases,) and is the better to work during the whole of the following season of tillage, than if ploughed later in the winter. The particular attention to this important object of early ploughing, for the next crop, causes it to be late before all the corn of the crop then made is housed. No night work in shucking the corn is permitted. Most of the crop is put up at first in the shucks, and shucked afterwards, during rainy or other bad weather.

The corn for seed is selected carefully—and ought to be changed every few years. The same necessity for change exists as to wheat—though in changing seed, Mr. Harrison would still adhere to the same kind, the purple straw, for the great body of the crop.

Oats.—Not much of this crop made, and only for part of the horse-food. Contrary to the prevailing opinion, and judging from his experience, the growth of oats is supposed by Mr. Harrison to be not so exhausting to the land as that of wheat.

Clover.—The uses, and some of the after management of this very important crop, have been necessarily anticipated in the preceding statements, and under other heads.

The seed is sown between the 5th and 25th of February, on the wheat succeeding corn. It is preferred to complete the seeding on the wheat land, if possible, between the 15th and 25th of February. On the oat land, the clover seed is sown immediately after harrowing in the oats, and of course later than on the wheat land, according as the season may permit the oat seeding to be done. The quantity of clover seed given is a bushel to 10 acres. Some of the best grown clover of the first growth of the second year after sowing is mown for hay—and more would be so disposed of if it were convenient at that time to devote more labor to that object. No perceptible lessening of the succeeding wheat crop has ever been observed on the places from which the first crop of clover had been thus taken off. Except this small extent of mowing, and the partial and light grazing, within limited times, before stated, all the growth of clover is turned under by the plough, as manure, either in August and September for wheat, or in November and December or later for corn, according to the rotation of crops—the former being required for the four-shift and the latter by the three-shift courses. These remarks apply to the two farms of the upper estate. On the two farms of the lower estate, as before stated, the difference of rotation requires a practice somewhat different. There the clover is grazed close during its third year of growth on that half of the field which was not fallowed for wheat the previous year. The portion of the field thus grazed in the third year of the growth of clover, and the fourth year of the order of the rotation, as stated at its place, comes under corn the next succeeding year, together with the remainder of the field, which had been put in wheat. This course, on the Lower Brandon and Church Pastures farms, has been found more improving to the land than the thorough four-shift rotation of Upper Brandon farm; but both of them less improving than the three-shift rotation in use on the Upper Quarter farm—and this rotation, in suitable circumstances of soil, crops, &c., is preferred both for improvement of land and for annual products, to either of the other courses.

Mr. Harrison's general views of the comparative merits of the three and four-shift rotations, and with such change as longer experience had caused in his mind, have been presented at length in several communications to the Farmers' Register.* His practice, in making use of both rotations, especially when examined personally,

* See p. 464, vol. ii., and p. 241, vol. iii.

offers the best commentary on, and justification of his doctrines, in this respect. It should, however, be observed, that by using both these rotations on contiguous farms, he is enabled to obtain the peculiar benefits of each, and to avoid the peculiar disadvantages of both, better than if pursuing either one of these rotations only.

Product of crops.—The growth of wheat is subject to such great disasters, and the products of different years are therefore so variable, that even if the general average product of acres and of years were accurately stated of any particular farm, it would furnish but a very inadequate idea of the true average power for production. Thus, on a field, that under very favorable circumstances may have produced 20 bushels to the acre, in another year, of the preceding or succeeding course of crops, under an unusual (but by no means unprecedented) degree of infliction of Hessian fly, chinch-bug or rust, might yield only 2 bushels. The average of these two extremes, would be 11 bushels per acre; which, however correct as a statement of actual average product, would be altogether false and deceptious as an indication of the degree of fertility, or progress of improvement. For these obvious reasons, the reporter preferred to learn and to state precisely the *best* products of wheat on each farm, for entire crops, from which each reader may for himself estimate what may be expected on the average of seasons, or in the worst of years.

The best crop of wheat which has ever been raised on the Lower Brandon farm, was in 1838, the average of the whole being within a small fraction of 19 bushels per acre. Two thirds of the whole surface under wheat was corn-land of the previous year, and one third only was clover fallow. The best crop on the Church Pastures farm was the same year, and averaged $17\frac{3}{4}$ bushels to the acre. A general average of years and of land, on these two farms, under the rotation pursued then and since, *supposed* to be 13 or 14 bushels to the acre.

On Upper Brandon, the best crop of wheat, on all the land sown (in 1838,) was 24 bushels to the acre. The general average of seasons and of land for the whole farm, supposed to be about 15 bushels. On the Upper Quarter farm, (1838) 16 bushels average—and a general average of seasons and of land, for that farm supposed to be 12 or 13 bushels to the acre.

The reporter would here remark, that these best products are not of the best few acres, nor of even but part of a crop. They are of the full wheat crop of each farm, each including its full proportion of inferior land. As all these best crops happened to be made in the same year, on four different farms, under their respective regular modes of cultivation, and under three different schemes of rotation, it is manifest that the greater than usual product was owing to a peculiarly favorable season, and not to the superior fertility of the fields producing the best crops. Such a superiority of land may well affect the result of a single year's product on one farm only, and still more if not under a regular rotation with fields of something like equal productive value. But on four separate farms, all under their respective and regular and judiciously planned courses of crops, it would be next to impossible that there should be a general and considerable superiority of fertility found in all the fields, seven in number, in wheat in any one year, of the four farms. The reporter therefore infers that the large crops made in 1838, were not greater than may be produced in any other year of equally favorable season and other circumstances, on whatever other fields might happen to come under wheat.

All the best crops of corn were also made in one year, 1840. On Lower Brandon and Church Pastures, the crop made a general average of 7 barrels (35 bushels) of corn per acre. The general average of years, and crops of both farms *supposed* to be about 6 barrels. On Upper Brandon farm, the same year, the crops averaged in product 7 barrels, and on Upper Quarter, 8 barrrels per acre. The general average of years and crops for the former supposed to be 6 barrels, and of the latter, 6 to 7 barrels per acre.

No product of clover has ever been ascertained; but the usual growth of the best land is believed to be now, and of latter years, as heavy as on first-rate soils elsewhere, either in this country or in England. As was before observed, when speaking generally of such lands along James river, clover was raised here before liming and the other parts of the recent system of improvement had been in operation. But, (as Mr. Fielding Lewis also reported of his Weyanoke farm,*) there was no good and regular success except on the highest improved lots. Clover did not answer under general field-culture. In one of the communications to the Farmers' Register, before referred to, (p. 242, vol. iii.,) in 1835, Mr. Harrison, after having just stated that his main reliance for future improvement was placed on his expected clover crops, made the following incidental remark: "My best [clover] has certainly grown after lime and manure. *Indeed, without the previous use of lime, my clover hardly pays me for the seeding;* but in a few years we hope to have the whole arable surface here improved in that way, having already more than half accomplished it."

Liming.—This, the foundation of all other improvements on these farms, was first begun on Lower Brandon, in or about 1819, by its proprietor, George E. Harrison, who had then but lately arrived at age, and the possession of his property; but who displayed in this, as in other things, his excellent judgment as a farmer and an improver, almost from his earliest operations. The liming there was continued for some years thereafter, at what was then deemed a rapid rate, though very far exceeded since, there and elsewhere, when all early doubts of the large amount of profit had given place to perfect confidence. During those first years, the amount applied did not exceed the lime burnt from 200 hogsheads of oyster shells in any one year. Afterwards, the rate of progress was greatly increased. Before the death of the proprietor, nearly all the land of Lower Brandon and Church Pastures had been limed over once; and much of the same land has since received a second and lighter dressing. The second liming has been usually applied to the parts of the fields which had remained two years in clover, and preceding corn.

It was 11 or 12 years after the first liming on

* Report of the farming on Weyanoke, p. 17, vol. i., Farmers' Register.

Lower Brandon had been done, before William B. Harrison had commenced; but when induced to begin, by the example and success of his elder brother, and by the still older experience and more valuable lights and instruction of their old friend, Fielding Lewis, (to whom all concur in awarding the honor of being the pioneer and leader *par excellence* in this important agricultural improvement in Virginia,) the greater rapidity of progress on the Upper Brandon estate made amends for the late beginning. The liming was commenced in 1830, and both the farms had been completely limed, the first time, by 1838. The largest operation of any one year was 1900 hogsheads of oyster shells, bought, burnt, and applied. About one-fifth of the surface of both farms has been since re-limed.

The shells are brought from the oyster landings on the salt waters of James and York rivers, in vessels that make it a regular business, and are sold, on board the vessels, lying off the farmers' landings, at prices varying from 50 to 70 cents the hogshead, or 18 heaped bushels of shells. The purchaser has to take the shells from the vessel, with the assistance on board the vessel of the crew. The manner of burning and of distributing over the land pursued at Brandon is much the same as that of Mr. Lewis,* except that the kilns are put up with much less care and trouble—being merely heaps of wood and shells in alternate layers. In this manner, a cord of wood, or rather more, serves to burn 10 hogsheads of shells. By burning, (and before being slaked,) the shells are reduced in bulk about one third, or 100 bushels of shells measure out only 66 to 70 bushels. 72 bushels in this state, were put to the acre, of land ready ploughed for corn, by placing half a bushel to each check of 18 feet square. When air-slaked, and either by first covering over the heap with the surrounding earth, or without, the heaps are spread, and the land immediately harrowed, to divide and diffuse the lime properly, and mix it well with the surface soil. Mr. Harrison has made no estimate of the full cost of liming, in labor as well as money. His brother had estimated it at 10 cents the bushel, or, for such a dressing as the above at $7.20 the acre. And costly as this may seem, and alarming to the inexperienced, there is no farmer on the river who has limed to considerable extent, and in judicious manner, who does not regret (as a great and certain loss of profit in the omission,) that he did not encounter this expense earlier, or more rapidly than he did.

Mr. William B. Harrison re-limes at half the above rate, or 36 bushels to the acre; and he would now advise the putting no more than the latter quantity even for the first time of dressing, as he has seen injury produced by the too great quantity at once of 72 bushels. Decided and early beneficial effect he has always found to follow the first liming; and he has no doubt of benefit having also been produced by the second applications; but such would of course be less obvious, and has not always been observed. Mr. Harrison thinks liming to be the cheapest and best kind of manuring, counting both cost and returns. The gross products of the Brandon lands have been increased to double, since the occupancy by the two proprietors—and fully a third, in corn and wheat, since the liming. Of course, when gross products have been doubled on the same, or nearly the same amount of surface cultivated, the net products, or clear profits of farming, must have been increased in a far greater proportion.

Lime is the main source of improvement by other manuring, by its producing clover to be used as manure, and also by the farm-yard and other putrescent manures becoming much more operative on the land after lime has been applied. Of the latter important effect, no doubt is entertained. Before liming, clover was not so generally sown, and the crop often failed; and gypsum had on it but slight effect, and was not often used. There never had been a heavy field crop of clover in Brandon Neck, (though smaller spaces of the best land had sometimes produced very well,) until in 1835. Latterly and since liming, gypsum is regularly sown, at one bushel the acre, on clover, the spring (or second year) after sowing the clover. The effect is believed by Mr. Harrison to be always good and profitable on limed or originally good soil; but he is doubtful as to the unlimed, if originally poor, or even on land not of very good original quality.

The gypsum is sometimes bought ready ground, but more generally in the lump, and crushed at home, by a corn-crusher. The usual price, in the lump, is $5 the ton; but one cargo from Massachusetts was bought as low as $2.70. The ton measures 20 bushels or more when ground.

Live stock and putrescent manures.—The subject of prepared or putrescent manures cannot well be considered separately from that of the live-stock, which serve to produce so important a part of the value of these manures; and the management of the stock is a necessary introduction to the production and management of the manure.

Cattle.—There are about 75 head of cattle on each of the four farms. Their quality inferior, and their general order also, when seen by the reporter in April. The cattle on the lower estate are of better quality than on the upper. The keeping and treatment in winter are very good, so far as serve plenty of good long forage and litter, the offal of the large corn and wheat crops, and sufficient shelter from wet and cold. But this care, during all the season for keeping the cattle on dry food, does not compensate for the want of a sufficient and regular supply of good green food through the grass season. The restrictions on grazing the clover fields is one of the rules referred to before which operates admirably well for sustaining and fattening the land, but badly for fattening the cattle. The resources for the cattle, except when in the farm-yards on dry food, are the standing pasture already mentioned, furnished by the mere land margin of Kennons' Marsh for Upper Brandon farm, 130 acres of inferior land in standing pasture on Upper Quarter—and on both these farms, the grazing of the wheat field and young clover thereon for a short time after harvest, and the older clover late in the year, say in September and October. On the lower estate, also the half of one clover field on each farm, in the third year's growth of the clover, furnishes all the pasturage, except 30 acres of standing pasture on the Church Pastures farm.

* See p. 18, vol. i. Far. R. for more full description.

There being as few fences as possible (except the general outside enclosure) on both estates, there are none designed specially to separate the grazing land from the balance, and the cattle are restrained to their allotted space by being herded or guarded. This plan is however about being altered to some extent, and proper fences for the standing pastures were in the course of being constructed. This herding plan, though a great saving of fencing, and a great aid to the land, by preventing very close grazing any where, cannot be otherwise than bad for the cattle. They are harassed both by the attention and the neglect of the herd-boys—and are debarred from seeking and enjoying, at will, the full supplies of food, water, rest, and shade, that they need. Even if enjoying all these to the fullest extent for a week, the neglect or ill treatment and privation of a single day may undo all the benefit received during the week of proper indulgence. Under this plan, a stock of cattle can scarcely do well. And of these evils the reporter may presume to speak thus, as he has long pursued this same plan of herding, to save the expense of fencing—and he knows well its particular disadvantages to stock, as well as the benefit to the land and to its product. He still deems the balance of advantages greatly in favor of this plan, and it is still pursued on the farm in which he has a share, except so far as having a small enclosed standing pasture.

It is therefore by no means designed as a subject of censure, in the general, when stating the objections which apply particularly to the cattle and grazing management on the Brandon estates. The making of manure is the great object there sought and gained by the keeping of cattle; and except this, there is very little of other benefit, except that of furnishing plentiful supplies of milk, butter and meat, to the families of the proprietors, and the breeding and raising oxen for labor. There are no sales of products of stock, except about 100 lbs. of butter from the upper estate, and 150 lbs. from the lower, and some few veals from both, annually.

Horses, and stable management.—On each farm, it is made the regular business of a suitable hand to clean out and then litter the stable, and chop up the long forage, (corn-fodder or clover hay,) with a straw-cutter, and have the proper supply ready in the trough of each horse, when brought in from work, so as to save time. The allowance of corn is 5 large ears to a mule at each feed, three times a day. To large horses and unthrifty animals, more corn is given. Of the long forage, there is always an abundant supply on hand, and it is given freely, chopped as above stated. And were this allowance less abundant, more corn would be necessary.

The corn is sometimes crushed in the ear, for horse-feed, and it is highly approved. The practice was introduced on Lower Brandon by its late proprietor, and has been continued since. It is not supposed that there is any great saving in the allowance of grain—but the animals seem to thrive better, and require less long forage.

The stables are fully littered at all times. In cold weather, the litter and excrements are suffered to accumulate for ten days or even two weeks as may be most convenient. But in warm weather, Mr. Harrison deems it necessary that the stables should be cleaned out every day. For the quality of the manure, if that alone were considered, he would prefer that it should be suffered to accumulate in the stables; but the main point, whether the stables be cleared out every day or more seldom, is that plenty of litter shall be used. The fire-fanging of the manure (which is the result of too high fermentation, and too little moisture,) is especially guarded against.

There are about 120 sheep (exclusive of lambs) on the upper estate, and 140 on the lower. The sheep are herded as the cattle are, and always penned at night, and they add considerably to the amount of manure. They are fed in winter on turnips, top-fodder, &c.

There are enough hogs raised and kept on Lower Brandon and Church Pastures to furnish for slaughter annually from 70 to 80 at each farm. The hogs have a good woods range, outside of the enclosure. 58 hogs were kept up in pens throughout last year, for experiment, until killed; and the result was so favorable, that the course is continued there, and has been also commenced on the upper estate. The hogs so confined were fatter when killed, and weighed more for their appearance than the other ranging hogs. At Upper Brandon, the hog management has been very unsuccessful. Not more than about 70 hogs are killed for bacon each year. It is necessary on the lower estate every year to buy much more pork for the farm supply, besides all that is raised; and there is a still greater deficiency to supply on Upper Brandon.

The cattle are kept in the winter farm-yard through the day as well as night; and until late in the spring—sometimes until the 10th of May. The sheep, during winter, are let out of the pen to graze in the day, when convenient.

Every portion of the offal of the grain crop, (corn-stalks and wheat straw,) not required for food, is used as litter, and converted to manure. There are no other sources of supplies of litter. The wood-land is so distant that the leaves are not deemed worth being brought to the farm-yard, and there are no wet natural meadows used for mowing. All the manure made before the 10th of March, is carried out on the field for corn, (already ploughed early in winter,) and spread and ploughed under before planting the corn. When very coarse, the manure is heaped in the spring and heated a little, to somewhat rot and reduce the coarser parts. The stable manure is sometimes mixed with the poorer manure of the cattle yard, to forward the rotting. The manure made in the cattle yard after March the 10th, is suffered to remain there, and is used the next spring. This delay is deemed advantageous, as such manure is very coarse. Top-dressing on clover, for which such coarse stuff is well suited, and can be cheaply so applied, has not been yet tried by Mr. Harrison; but he will do so. From the farm-yards and stables, there were manured for this crop, (part of the late made manure of last spring, applied in autumn for wheat on clover fallow, but principally for recent manure, to corn this spring,) more than 60 acres on Upper Brandon, and more than 40 on Upper Quarter—a good heavy covering, supposed to be about 60 two-horse cart loads per acre; besides the land manured by summer cow-pens, (without litter as usual,) and which would amount to 7 or 8 acres for each farm. On Lower Brandon

and Church Pastures, about 70 acres manured on each, of farm-pen and stable manure at the above rate, besides the summer cow-pens.

Distemper of cattle.—The mysterious and deadly disease of cattle called "distemper," prevailed to such an extent in or about 1830, that 54 head of cattle, died with it on the estate in one season. The cattle that died were in good order —which is one of the peculiarities of this disease, the fat animals being more apt to be infected than the poor. Since then, cases have only occasionally occurred. Mr. Harrison thinks that the mixture of tar, sulphur and salt, kept always in the pens during summer, and which the cattle will lick, has been the preventive against this terrible disease. He was advised to use this remedy by Mr. Fielding Lewis, who, as usual, was resorted to as the best source from whence to obtain information and judicious advice. When recommending the use of this medicine, Mr. Lewis stated that, before using it himself, he had formerly lost some few cattle almost every year; but since keeping it regularly in the cattle pens, he had never lost one of his stock by distemper, except a bull, which, by being confined separately, was debarred from access to the mixture.

Laboring force of teams and hands.—On the two farms of the lower estate, there are 38 to 40 horses and mules for the plough and other farm labor, and about 48 oxen. On Upper Brandon there are 18 working horses and mules, and 15 on Upper Quarter, and about 48 oxen on both these farms also. The small oxen raised here are more hardy, and bear labor with less fatigue, than the much larger oxen of the upper country.

On both farms of Lower Brandon, there are 70 field hands of all ages and kinds. There are also 6 other men, who are carpenters, sawyers, and black-smiths. There is also a saw-mill there to provide timber and plank for the buildings and other constructions of the estate. On the two farms of the upper estate, there are 60 field hands, besides 8 mechancis, who are not employed in field labor. No domestic servants are included, nor has any reference heretofore been made to any thing of either labor or expenditure except matters appertaining to the farming operations. The splendid mansion houses and beautiful gardens and ornamental grounds, of both the estates, and every thing connected therewith, however admirable or delightful, are not proper subjects for farm reports.

Agricultural implements and machines.—The ploughs used for turning in clover to sow wheat, are the four-horse and three-horse McCormick ploughs. Two-horse ploughs, of same pattern, are used for ploughing the corn land for wheat. For breaking up land for corn, the three-horse ploughs are used. All there are made by William Palmer of Richmond.

For tillage of corn or other horse-hoed crops, on flushed land, the two-horse double-shovel-ploughs are used and preferred to all others. Single-horse turning ploughs, used for the water-furrow row (or interval) of bedded corn-land. No cultivators used. At Lower Brandon, the X plough, a kind of cultivator, is sometimes used for covering seed-wheat and oats. But if the land be in good order, the linked harrows are used for that purpose. Mr. Harrison has heavier harrows, but prefers the lighter linked harrows.

A marker is used to mark off rows to plant corn. It is like a horse-rake, except that instead of the many rake-teeth, there are 3 small iron hoes, so formed and set as to make a plain but shallow mark, as the implement is drawn across the ploughed land. One of the out-side hoes runs in the last marked row, (if on level ploughed land) and the two other teeth mark new rows. This simple implement, which the reporter saw here, and adopted its use, with some modification, long ago, offers a great saving of labor over the general mode of laying off rows, by setting up poles to direct the course of the plough.

There is at Lower Brandon a good horse machine to gather clover seed, by combing off the ripe heads, but too costly. At Upper Brandon there is a rough and simple one, such as can be constructed by any farm carpenter—and which will serve the purpose well enough.

Hussey's reaping machine was here first tried last harvest and approved, (See F. R., vol. ix. p. 434,) and it will be hereafter used for part of the reaping, unless superseded by a better.

Parker's thrashing machine, for 8 horses, is used. It has not yet thrashed out but from 300 to 400 bushels of wheat a day. But if properly fixed, and properly supplied and worked, it is thought that it might thrash 700 or 800 bushels in a day.

The straw-cutters used are Parker's.

A corn sheller, worked by 4 horses is used—and shells from 250 to 300 barrels of corn a day.

A mill which was designed by its constructor to crush and grind ears of corn for home food, is used to crush and grind lump gypsum, for manure. It will grind 40 bushels a day, with two horses, but is heavy labor.

The hand utensils are not different from those used on most other farms.

THE TIMES OF THE RIPENING OF WHEAT IN DIFFERENT PLACES.

For the Farmers' Register.

It is desirable to know the period of harvest in the different parts of the United States, and I am not informed of any tables of comparative seasons that have been published.

There is an interval of many weeks between its commencement in the southern and northern portions of our wheat growing country. The harvest begins two months or more earlier in the southern counties of England than in Scotland. The interval may not be so great here, on account of the heat of our summers even in the northern states, but yet it is so considerable that the season may operate very differently on the crops at distant points of the union.

If the editors of the several agricultural papers would make notes of the time of beginning to cut wheat in their respective vicinities it would be both interesting and useful. It would enable us to make a calculation of the effect of the weather on the crops on an extended scale, and a more general estimate might be made of the harvest than when the farmer's knowledge is confined to his own neighborhood. We should also know when to expect that the new crop from different parts of the country would be received in the market.

In the south the weather may be favorable, when heavy rains occurring after our harvest may injure the northern crop: and on the other hand rains destructive with us, may be too early to cause any damage to the north. Wet weather about the 15th June would be seriously injurious in this latitude. Five hundred miles north of us the same weather might be beneficial.

I have known incessant and great rains up to the 10th June, succeeded by fine crops of wheat.

The rains within the ten days immediately preceding harvest are the most injurious.

Sometimes a promising crop is within a few hours of being ready for the scythe, when the rust spreads over the whole of it, diminishing the product by one-half or even more.

From this uncertainty of our climate, no calculation can be made of the wheat crop till we are fairly engaged in harvest.

The following is an extract from a memorandum kept for the last fourteen years, twenty miles north of Richmond.

1828. Began to cut wheat on 9th June. Early or May wheat.
1829. June 22d, late wheat.
1830. June 15th, with a few reapers, with all hands on the 18th.
1831. June 20th, do. do. 21st.
1832. June 23d.
1833. June 14th with a few reapers, with all hands on the 17th.
1834. June 20th, do. do. 23d.
1835. June 26th.
1836. June 28th.
1837. June 24th with a few reapers, with all hands on the 26th.
1838. June 25th.
1839. June 19th with a few reapers, with all hands on the 21st.
1840. June 12th. do. do. 15th.
1841. June 23d.

The crop every year after 1828, was exclusively of late wheat, as purple straw, turkey wheat or lawler wheat. The May wheats are generally ten days earlier than the late. The extremes of the time of beginning harvest, (excepting the May wheat in 1828,) are in 1840 the 12th June, and 1836 the 28th, making an interval of sixteen days. The crop of 1840 was not a good one, that of 1836 was wretched, and in this year there was a general failure throughout the United States. The crops of 1832 and 1838 were the best of the series. We usually count on finishing harvest by the 4th July.

I hope other agricultural papers will furnish similar statements, and if none of their correspondents can go so far back, let us have at least the dates of the harvest for the present year.

Your readers would be pleased to know particularly when the harvest begins in North Carolina, Maryland, Pennsylvania, New York, Michigan, Ohio and Missouri. W.

May 29th, 1842.

We ask attention to this suggestion, and aid to the proposed measure. We will furnish our mite of practical experience thereto, very soon. —Ed. F. R.

ADDRESS BEFORE THE CAYUGA COUNTY AGRICULTURAL SOCIETY, AT AUBURN, N. Y., FEBRUARY 1, 1842.

By David Thomas.

Geologists inform us that soils were chiefly derived from the wear and tear—the disintegration and decomposition of solid rocks. In some tracts of country, the soil is nearly identical with the rock that immediately underlays it, or partakes largely of its nature; but such occurrences are rare in this county. So extremely active was the deluge that swept over and rounded our highest hills, that many a square league of stony strata was entirely buried by materials that drifted from other parts of the country, and which have no resemblance to the rocks they cover.

Favorably for the southern parts of our county, that deluge came from the north, sweeping over a limestone region, and depositing, in its course over our barren state, the rich collection it had made. And here let us stop to consider: if that flood had come in an opposite direction, bringing along the unproductive detritus of the mountains, instead of our fertile fields, and flocks and herds, we might have witnessed nothing more inviting than scrub oak plains, and a few wandering deer.

Like other floods, however, its deposites were irregular, as its velocity was increased or retarded—as it whirled into eddies, or rushed onward in its course. Pure clay, indeed, can scarcely be found in this formation; but all the varieties of loam, whether clayey, sandy or gravelly, occur; and some deep beds of both sand and gravel, are so pure as not to discolor the water into which they are thrown.

Such instances however are rare; and the grinding and mixing of so many instances by that deluge, have been eminently beneficial to our farms. No soil is fertile, says Humphry Davy, "that contains as much as 19 parts out of 20, of any one material or constituent." On the contrary, soils that contain mixtures of many things, are generally very fertile,—provided that clay, lime, and sand, form a large share of the mass. When you see, therefore, old mortar, the sweepings of the smith shop, or leached ashes thrown into the highway, you may safely conclude that the owner is greatly in want of instruction. These are excellent manures, and permanent in their effects.

Perhaps some would ask, why are different things necessary to constitute a fertile soil? Allow me to answer in the language of Dr. Jackson's Geological Report on Rhode Island; "Chemical science arranges all bodies as electro-positive, or electro-negative. The electro-positive are always the alkaline or basic substances, while the acids are always electro-negative when brought in contact with matters of the positive class. If a soil is wholly positive or negative in its nature, it fails to be fertile; and when one power greatly predominates over the other, it is not in its most favored condition. Silex is regarded as an acid, and alumina, lime, magnesia, iron, and the alkalies, are its opposites."

According to this view, the soil may be considered as a vast galvanic battery. "It is ren-

dered nearly certain," says an eminent writer, "that manures act by the salts they contain, acting when brought in contact with the earths in producing galvanic currents," and of course stimulating the plants in their growth. On this subject, however, I give no opinion of my own, because I can comprehend much more clearly, the neutralizing effects of acids and alkalies, and the absorbent powers of the different materials. This view may regulate our practice quite as well as the former; and indeed there seems to be nothing discordant between them.

It is not many years since the existence of acid soils was denied, or overlooked. The editor of the Farmers' Register, in Virginia, was the first to point out the error or oversight; and the subject is now better understood. He furnished no evidence indeed of the presence of uncombined acid; but the circumstantial evidence was very strong and pointed; and in my judgment he fairly made out his case. Since the publication of his "Essay on Calcareous Manures," other writers of great respectability have either adopted his views, or furnished additional and positive proofs of their correctness.

The question may occur, why is not an acid soil as fertile as any other? It is more fertile than any other for such plants as the red sorrel; but not for the plants which are the chief object of the farmer's culture. These generally require a neutral soil—that is, one in which lime, under some form or other, occurs in considerable quantity.

Although clay, according to Dr. Jackson's classification, is arranged as an alkaline earth, yet, as such, it is so feeble, that when united with *silica* or sand alone, the mass becomes acid, and unfitted for our usual crops. On such lands, Indian corn assumes a yellow sickly aspect, even when it is not injured by stagnant water. And what is the cure? Apply lime enough, and then, says an accurate observer, "the young corn takes immediately a deep, healthy color, before there is any perceptible difference in size. The crop will produce from fifty to one hundred per cent more the first year, before its supply of food can have possibly been increased.* And why? Because the poison which has paralyzed it, was destroyed.

It is well known that when magnesia occurs among quick-lime, it is often injurious to the land. Such a mixture is called *hot lime*, from its burning alkaline quality,—the magnesia not combining so speedily as lime does, with carbonic acid, which would render it mild. Besides, the lime, having a stronger attraction for that acid, will either be served first, or take it from the magnesia till it has got enough. I have seen spots of earth, where large heaps had been thrown down to slack, remain barren—as free from vegetation as this floor—for two or three years, although the ground had been carefully scraped over when the heap was removed.

Yet such is the stuff to which the south-eastern part of Pennsylvania owes much of its fertility. Formerly, when I lent a hand to that process, it was considered that 30 or 40 bushels to the acre were as much as the land could bear without injury. It was found, however, that rich land would bear more than poor land; and in process of time they discovered that 100 bushels to the acre might be safely and profitably applied to pastures, or meadows. The lime was slacked in large heaps; and then from a cart or wagon, on a calm day, it was scattered with a shovel evenly over the grass. It fell among the decaying leaves, which in warm weather yield carbonic acid, and it became mild without injuring the crop.

Some years ago, I published an account of this simple method, believing it superior to that of any other country, and you may judge of my surprise to see it stated in a work of high authority, bearing the date of 1840, that magnesian limestone is unfit for the purposes of agriculture!

Lime, however, possesses other properties besides that of neutralizing acids. One of the most remarkable is the power to absorb putrescent manures; and to hold the fertilizing essence till it is wanted by the crop, through every vicissitude of the seasons, and through indefinite periods of time. There it is, locked up; and nothing at common temperatures, but the energy of a growing plant, can unlock it.*

Lime has therefore been styled the basis of all good husbandry. It stores up the manure that is not immediately wanted, for future use—a kind of *save-all*. When the supplies from the barn yard are spread and ploughed into a soil that is nearly destitute of lime, the growing crop catches a part of its virtue; but a very large part escapes, and very little will be left for the benefit of those that succeed. I had been used to such soils until I removed to my present farm; and was then agreeably surprised to see how much more durable were the effects of stable manure. My fields were limed by the deluge.

Unwholesome vapors and villanous smells are also absorbed by lime; and some places, once remarkable for insalubrity, have been changed in their character by liming or marling the fields around them. Nuisances are converted into manures. A striking illustration of this principle is contained in the following account from the Essay on Calcareous Manures.

The carcass of a cow, killed by accident late in the spring, was laid on the ground, and covered by about 25 bushels of broken shells mixed with 45 bushels of earth chiefly silicious. After the rains had settled the heap, it was only six inches thick over the highest part of the carcass. The process of putrefaction was so slow, that several weeks passed before it was over; nor was it ever so violent as to throw off any effluvia that the calcareous earth did not *intercept in its escape*, so that no offensive smell was ever perceived. In October the whole heap was carried out and applied to one sixth of an acre of wheat; and the effect produced far exceeded that of the calcareous

* Essay on Calcareous Manures.

* The following extract from Liebig's Organic Chemistry, is cited as a parallel case:

"An abnormal production of certain component parts of plants, presupposes a power and capability of assimilation, to which *the most powerful chemical action* cannot be compared. The best idea of it may be formed by considering that *it surpasses the power of the strongest galvanic battery*, with which we are *not* able to separate the oxygen from carbonic acid." p. 184.

manure alone, which was applied at the same time on the surrounding land.

The same valuable work contains a caution to the farmer which may save him from a dangerous error. "He is not to suppose that calcareous earth can enrich a soil by direct means. It destroys the worst foe of productiveness, [acidity] and uses to the greatest advantage the fertilizing powers of other manures; but of itself it gives no fertility to soils, nor furnishes the least food to growing plants." In other words, it is the strong box for the treasure, but not the treasure itself.

Lime also possesses the property of making sandy soils closer and firmer, and clayey soils lighter. It is a mean between two extremes.

I was conversing several years ago, with a farmer from a sandstone district, who expressed some surprise that 40 bushels of wheat could be raised to the acre. "I don't believe," said he. "that our land could be made rich enough to produce such a crop—it would lodge." I am entirely of the same opinion, unless lime be employed. Stable manure is too stimulating—the stem grows too rapidly—it is succulent and weak. Whether the lime by combining with silica assists in stiffening the stalk, or not, we may be certain at least, that it yields nourishment as the plant needs it; and that every part will be healthy and properly developed.

Professor Emmons says in one of his Geological Reports, that the most fertile soil formed artificially, by the mixture of different earths, yielded on analysis 37 per cent. of carbonate of lime. As it is known, however, that lime in some soils soon ceases to be a carbonate,* it is probable that the real quantity of lime was even greater than what was indicated by the analysis. I have seen soils of remarkable fertility, that naturally contained a very large proportion of lime; and there is no danger of having too much when it is properly applied.

In drought, how are plants supplied with water? After a shower, the soil may be wet enough for a time; but when the sun and wind dry the surface, the moisture rises up from below by capillary attraction, as the melted tallow rises up through the wick of a candle to supply the deficiency above. It is from this circumstance that our crops over deep beds of sand suffer less in dry weather than where the subsoil is hard and impermeable—showing the benefit of deep and thorough ploughing. In either case, however, as the supply begins to fail, and the soil grows drier, its finest parts absorb moisture from the air; and the plants are constantly nourished by this invisible fountain.

But the different constituent parts of the soil act with different degrees of energy.† Of the earths, the silicious is the weakest,‡ and the aluminous the strongest, while lime holds an intermediate position. Not one of these however would do by itself. We want sand, because no soil consisting entirely of impalpable matters is fertile;* and we want it to keep the soil loose, so that the air can enter its pores, and give up the water which it holds as vapor.—Without such assistance, stiff clay or aluminous earth would absorb but little moisture from the atmosphere, because it cakes, and shuts out the air. Lime is also a valuable auxiliary in rendering the soil more absorbent, independent of its other indispensable qualities.

But the soil, however it may be tempered and constituted, can never be absorbent in a high degree without culture. Some crops indeed require more of this quality than others. Thus Indian corn requires more than wheat; and wheat more than the grasses of the meadow. But vegetable and animal matters are more absorbent than the earths; and culture only can properly introduce them into the soil. Even when there, frequent stirring is necessary to keep the ground loose and the pores open, for the free admission of the air and the easy passage of the roots.

Our coats sometimes become spotted with mud. We apply the brush, but the bristles pass over without effecting its removal. What is the reason? The clay which was suspended in the water, forms a glaze or crust. It is just so with the interior of a soil which has laid long unstirred. The clay forms a crust round the inside of all the little cavities, preventing the free circulation of air, and the introduction of moist vapor. The fertilizing principles are excluded.

The celebrated Tull, observing the extraordinary effects of high culture, concluded that plants fed on mellow earth, and Duhamel adopted the same notion. Their philosophy was *coarse*, but their practice was *fine*. If we were to follow their example, making plenty of fine earth for the plants—not to *feed on*, but to *drink from*, our crops might be greatly increased. One of the chief errors of our husbandry is to cultivate too much land, because it is only half done. Half the quantity with double the work on it, and double crops would be found more profitable.

I have long believed, however, that no part of the system required reformation more than our management of manures. Manure has been called the wealth of the farmer. When it is taken out in the spring, it is commonly scattered over the ground in large lumps; the plough comes along and covers them, or not, as the case may be. If covered, they intercept the ascent of the moisture from below, especially in dry seasons. If not covered, they lie wasting on the ground—of very little value. Indeed some excellent farmers have satisfied themselves that strawy manure is unprofitable for summer crops.

I am far from holding that opinion, however. The error consists in not applying it to the soil in the best manner. In the spring of 1840, I had no ground for field beets, but a small lot where corn had grown for two years in succession. It was unfit for such a crop without manure; and I had only fresh manure from the stable, which has long been considered most unfavorable to the beet. My necessity, however, prevailed against opinion; and I took the responsibility. From each line where the beets

* Essay on Calcareous Manures.

† Davy's Agricultural Chemistry.

‡ "Sand gives little absorbent power."—*Agric. Chemistry.* "Sand is incapable of absorbing moisture from the atmosphere, or of retaining any valuable vapor or fluid."—*Essay on Calcareous Manures.*

* Agr. Chem.

were to grow, two furrows were turned so as to leave a wide dead furrow. Into this the manure was thrown from the wagon, each forkful touching the one just behind it, till the row was completed. It was well covered by turning two furrows together over it, which *held it down* while the harrow was passing four times in succession, breaking, pulverizing, and mixing it intimately with the soil. Again two furrows were turned together over the row, and the harrow passed twice more—in all, six times. By this process the ground was reduced to a fine tilth; and if there were any better beets in the county, I did not see them.

To me, it was a most instructive experiment. I have often seen manure applied to corn fields, but never in any case where it was so completely incorporated with fine earth. Even in the driest part of that season, the ground was always moist and mellow.

I am satisfied that we have been too saving of our harrows. Thirty years ago, there was a method of ploughing in this country called '*cut and cover.*" It was ploughing, not to the *shares*, but the *halves*—the furrow slice covering the space where a furrow ought to have been. I am apprehensive that our ideas of harrowing were learned in the same school. When grain is sown, is it not the prevailing opinion that it is harrowed enough when the seed is covered? I had a narrow land harrowed sixteen times in one day, and was satisfied that the labor was well applied.

For beets, or corn, or potatoes, what would be the effect of ploughing in a heavy dressing of stable manure, harrowing twice, and repeating the operations of the ploughing and harrowing four times more, adding each time to the depth of the soil? I have not yet performed the experiment, but the nearer I have approached it the finer has been the crop. Thorough culture would seem to require that every little lump should be broken, so that the roots could wander freely in every direction, and that every drop, of a summer shower, should be caught and retained for future use. Hard land and thin soils have some resemblance to a dish bottom upwards.

An instrument for pulverizing the soil was invented a few years ago in Virginia, by Thomas B. Gay. It is called the drag-roller, for it operates just as a roller would that does not *turn*, but *drag*. Take a hollow log, six or seven feet long, split it in two, and one half would serve for this instrument. The greater the diameter, the easier it would run; and be less liable to clog by gathering clods before it. Three feet would be better than two, though either would answer. Frame two pieces of scantling into it, connecting them in front; and to this fixture the team is to be attached.

Do you believe that clods as big as a man's fist, or as big as his head, are more useful to the crop than stones of the same size? I do not. But if we can break them—grind them to dust—and leave them on the land, they would do as much good as other mellow earth of the same bulk. Now in warring against the clods, this instrument is formidable; and most so before they become thoroughly dried. On the same day therefore that the plough turns them *up*, let the drag-roller grind them *down*; and let me suggest that lumps of barn yard manure would escape not much better.

Stable manure, however, is often saved for the wheat field; and at any time during the summer, either before or after harvest, it is taken out and thrown into heaps, where it lies wasting until seed time. It is then thrown round into large lumps as before mentioned, the plough covering some, while others too big to cover stick up over the field. If the wheat is harrowed, perhaps some of these pyramids are upset or demolished; but often the harrow serves them as the plough did—gives them a shove and passes on. Now it seems very clear to me that manure applied in this way is comparatively of little value.

There is another class of farmers who manage things differently. Soon after the warm weather commences in spring, they collect all the manure of the barn yard into large heaps; and work it over, two or three times in the course of the summer, so that the straw may moulder and be more easily mixed with the soil. This advantage—the only one that I can discover, is indeed secured, but at a heavy expense. The best part of the manure passes off to visit their neighbors, or roam at large through the atmosphere, leaving the worst part, though still of some value, for the owners. The praise of industry is theirs, and the reward of working for nothing and finding themselves.

Another set of farmers, more interprising still, make up all their barn yard manure into compost. This is done by successive layers of manure, rich earth, and lime, together with any refuse stuff, animal or vegetable, that may be at hand—to be turned and mixed several times in the course of the season. Such manure is always valuable; but with a little more knowledge, its value might be much increased.

Let us consider this subject. From a heap of fermenting manure, a vapor continually rises, very different from the exhalation of a pond, as our noses might testify. Perhaps some may think that such thin diet as that would be of no consequence to a plant; but I can assure them it is the best part of the manure. Humphry Davy filled a three-pint vessel with a bent neck, from a fermenting heap of stable manure while it was hot, and turned the beak among the roots of some grass. Nothing but vapor left the vessel; yet in less than a week the grass grew with much more luxuriance than the grass in any other part of the garden.*

The value of this vapor is therefore evident; but how shall we save it? In the first place, the fermentation should be very gradual. Make the heap in the shade, or on the north side of a building, and manage it just as you would manage a coal-kiln. The more the air is excluded the slower and better will be the process. Now covering it with earth will have this effect; but vapor will rise even when it ferments slowly, and therefore marl may be freely scattered through the heap as it is made; but no quick-lime. Lime, indeed, should form an outside covering for the whole pile (when marl is not at hand); but it should be carefully prevented from coming in contact with stable manure, or any

* Davy's Agricultural Chemistry.

animal matter. It must not touch them. It spoils them. A layer of earth should be interposed ; and then the lime would be highly useful in catching and retaining the fertilizing vapor as it rises.

I believe there is no difference of opinion on this subject among chemists. Humphry Davy speaks in the plainest language against mixing quick-lime with common dung as injurious ; and other eminent men fully accord with the doctrine. On the outside of the heap, however, quick-lime in a few weeks would be carbonated ; and after undergoing this change, it might be safely mixed with the compost. A fresh coat may then be applied.

But some farmers may not wish to apply their barn yard manure in the spring, or make it into compost—they may prefer using it after harvest, and yet not have it wasting in the mean time. In that case I would advise that it be thrown inward where it lies thin, just so far that this work conjointly with the work of covering it, shall amount to the least labor. Then cover the whole with straw or earth to protect it from the sun ; and cause it to be trodden down by the cattle as firmly as possible to exclude the air, and prevent fermentation. Some of you may recollect when forking up such matters after harvest, that the straw in spots was bright and unchanged. That was where it was well trodden. All change is attended with loss ; but as some change may be expected strew lime or marl and plaster plentifully over it, to absorb, or arrest the fertilizing vapor.

The effect of plaster (composed of lime and sulphuric acid) has long been a source of wonder ; for it was a wonder how one bushel could add more than 20 times its own weight to a crop of clover. Inquiring minds of course have been busy in trying to explain the mystery ; but I doubt if all the properties of this manure are understood even at this day. Humphry Davy was inclined to think that plaster was a necessary part of the woody fibre of some plants, analogous to the bony matter in animal structures. The plant could not do without it, though it wanted but little ; and hence so small a quantity had such a powerful effect. " Plants which seem most benefited by its application," says that eminent chemist, " always afford it on analysis."

When this theory was announced some thirty years ago, it was rejected in this country, where the effects of plaster were much better known than in England, but if he could have shown that it enters into such plants in any definite proportion, some of the arguments against him might have been refuted. It appears, however, that he never pursued the inquiry with much interest.

Judge Peters of Pennsylvania had done more than any other person to extend the knowledge of this manure, and to favor its introduction. He had been very diligent and minute in his inquiries ; and though not a professed chemist, became satisfied that sulphuric acid was the active ingredient in plaster. He showed, from the observations of Berard, that lands near Catanea in Sicily, abounding in volcanic matter, including sulphur,* were very fertile ; and from an experiment by the same person, that brimstone, pounded, sifted and mixed with ashes, had a surprising effect on lucerne and clover. Sulphuric acid greatly diluted with water, had a similar effect.

As a further confirmation of the effects of sulphur or sulphuric acid, when Chancellor Livingston was travelling in Flanders he saw the farmers preparing pyrites for manure. This mineral is a combination of sulphur and iron, and when partially burnt is employed in the same manner, and for the same purpose as we use plaster. Dr. Chapman of Pennsylvania found a similar result from sulphuret of barytes.

Last summer, a new work called, Organic Chemistry, by Professor Liebig of Germany, was first published in this country ; and it has been considered by those best qualified to judge, as constituting a new era in agriculture. It is not my intention, however, to detain you with any of its details, except his explanation of the effect of plaster on growing plants.

Ammonia is an essential part of the food of plants. It affords all vegetables, without exception, with the nitrogen that enters into their composition. It is very volatile ; but sulphuric acid (furnished by the plaster) can prevent its flight, and fix it in the soil. This can only be done, however, when the plaster is dissolved. The sulphuric acid then unites with the ammonia, and the carbonic acid of the ammonia unites with the lime.

Such is the purport of Professor Liebig's explanation of this great mystery. If he is correct in ascribing all* the effect of plaster to this new combination, its importance in the economy of our farms must be evident. All our fields, pastures and meadows, ought to be strewed with it ; and in accordance with his suggestion, it ought to be scattered in all our stables, and over all our barn yards. The quantity required is not great ; and many experiments may be instituted at a trifling expense.

I ought to say, however, that this theory appears insufficient for explaining all the phenomena, in connexion with the use of plaster. Why is its effect on clover so extraordinary, and on wheat so insignificant? Judge Peters, after using it forty years, said he never found it beneficial on winter grain ; and others, after long trials, thought it did little for the natural grasses. All these, however, are powerfully affected by stable manure—by the very ammonia† which that manure yields. And what do we observe? Clover of luxuriant growth, and close along side of it, wheat without any indication of benefit received, though both have been plastered alike.

Again—Professor Liebig informs us that every shower of rain, or fall of snow, brings down ammonia to the ground where the plaster ought to arrest it, and the plants that feed on it ought to be more thrifty ; but we have much testimony to

* A late traveller writing from Italy, says of the peasants residing in the neighborhood of Vesuvius—" If their houses are burned, they return, when the lava cools, to build new ones, and cultivate *a soil inexhaustibly fertile.*"

* " The evident influence of gypsum upon the growth of grasses depends only upon its fixing in the soil the ammonia of the atmosphere."—Liebig, p. 142.

† "Animal manure acts only by the formation of ammonia."—Liebig, p. 136.

show that on many fields no trace of such improvement could be discovered. These facts may not be inexplicable; but they appear to me at present, quite sufficient to hang a doubt on.

I am aware that we have statements in regard to the use of plaster, of the most conflicting kinds, so that with some few exceptions what one denies, another affirms; but would this be so if it acts solely in the manner described by Professor Liebig? A simple cause might be expected to produce a uniform effect. For instance: poudrette is a simple cause; and as far as I have understood, it operates with uniform effect, whether on clover, wheat or cabbages.

On some soils, indeed, plaster is uniformly inefficient—not the trace of any effect is perceptible. This inertness has been more frequently observed in the *tertiary formation* near the sea coast; and therefore it was ascribed to the salt vapors. Plaster, however, succeeds well in many places on the coast, and fails in others far beyond the sea breeze, so that the cause seems to reside in the soil, and not in the air.

There are several substances that decompose plaster, besides the cabonate of ammonia. Carbonates of potash and soda have the same power. In the hands of the chemist, plaster and common salt readily change into sulphate of soda, and chloride of lime; and Judge Peters said, "I ruined a bushel of plaster by a handful of salt—it was unfit for either cement or manure." Some of the oxalates also effect its decomposition.

When this happens, the plaster no longer exists: and most of these results are not known to be of much value as manures. Such failures, however, rarely occur on calcareous soils, or on such as contain a due proportion of lime. There plaster generally proves beneficial; and even in England it has succeeded on such lands. Many years ago, in the south-eastern part of Pennsylvania, some farmers thought it would supersede the use of lime; but it gradually lost its effect; regaining it, however, when the land was limed. Wherever plaster proves of no use, therefore, try liming. On a small scale, it may be done at a trifling expense; and may lead to the most beneficial results.

And remember that plaster must be dissolved before it can do any good. Sometimes there is not rain enough for this purpose in summer, and therefore, there is always a risk to sow it late in the spring. Let it be done early.

I have now arrived at my last paragraph. From bogs or deep swamps manure may be manufactured to a great extent. Three parts of peat and one of stable dung are mixed together, and fermented through the summer. It was used in England* many years ago; and has been found in New England, equal to the same bulk of stable manure, and more permanent in its effects. †

CASKS FOR PRESERVING GRAIN.

From the Farmers' Cabinet.

Mr. Editor—On a late visit to a branch of the Cooper family, New Jersey, I observed that the granary, or place for stowing away grain of different descriptions, was fitted up with bins in the shape of very large and strong iron-bound casks of the usual shape; and in these, the wheat, &c., was preserved for any period, no matter how long, without fear of weevil, grain-worm, or any other species of vermin, or damp and mouldiness; the grain being introduced by means of a funnel through the bung-hole, which, when the cask is full, is very carefully closed and made air-tight, the hoops being driven occasionally to cause them to become so. Now by this very simple arrangement, the whole crop of grain on a farm may be preserved for years, as perfectly free from dampness or disease of any kind, as though it had been kiln-dried; the convenience of stowage being as great as in open bins; the casks standing on low tressels or sleepers, admitting a bushel measure under, they can be rolled on to the bung; or the grain might be drawn off by a large tap made for the purpose.

HISTORY OF THE CANE.

From the South Western Farmer.

We promised in a late number a history of the seeding and growth of the cane, which a few years ago was found in such abundance in nearly every part of this country.

At the first settlement of our state all the richer lands were found covered with a growth of this singular plant, so dense that travelling through it ten miles a day, with severe labor, was quite as much as could be done, and the only way to get an extension of vision further round than ten or twelve paces, was to mount a tree or some other eminence higher than the tops of the cane. The size and height of the cane varied with the quality of the land. On thin land it was found not thicker than one's little finger, and not higher than 4 or 5 feet. Increasing in size as the land was better, it was occasionally seen from two to three inches in diameter, and attaining the height of 30 or 40 feet. Until the year 1830 a considerable portion of the present corporation of Vicksburg was one of the thickest and heaviest kind of cane brakes, and all the uncultivated parts of that most fertile region of the world perhaps—the hills which strike the Mississippi just above Vicksburg at old Fort McHenry, and continue to skirt its shores as far as our boundary line extends, were clothed throughout with the perennial verdure of the cane's most graceful foliage. During that year nearly all the cane of this range of hills, and we believe of the interior on this side the Mississippi, blossomed, seeded and perished. The seeding did not extend to Louisiana, unless in a few small spots, nor did it extend to much of the river bottom on either side; and there were occasional clumps which did not seed until the following year, together with some that did not seed at all; though such were soon destroyed by stock.

The ripening of the vast quantities of seed during the summer of that year (1830) presented in those parts of the country where the cane was abundant, scenes of overflowing plenty, unequalled in any other land than one of fable. The grain was about the size of a grain of rye, and be-

* Davy's Agricultural Chemistry.
† Jackson's Geological Report on Rhode Island.

gan to ripen towards the latter part of July. Each cane sending out a head of seed at the extremity of every leaf branch would yield perhaps a quart, and so heavy as frequently to bend the cane entirely to the ground. Cattle, hogs, birds, squirrels, and every thing which fed on it, became seal fat, and reveled until winter in the midst of the wasteful gencrosity of nature.

After ripening its seed, the cane withered and died entirely, though it did not fall to any great extent till the following year. It was then thoroughly matted over the whole surface of the earth, forming a layer of 6 inches or a foot of dry and combustible matter.

Those who have never witnessed that most sublime spectacle—a field of dead cane on fire—can form no idea of the scenes then frequent among us. A prairie on fire has often been the theme of description. But the terrific magnificence of the conflagration of a cane-brake we think unequalled. The fire may be known at the distance of 6 or 8 miles by a roaring like the coming of a hurricane, and a thick column of black smoke which rolls up in the horizon over the spot of the conflagration. Nearer to the scene, and yet not in sight, the incessant reports, caused by the explosion of the heated air in the joints of the cane, brings to the mind nothing more forcibly than the idea of embattled armies engaged by myriads in the work of death—while the giant monarchs of the forest, consumed at their roots by the devouring elements, occasionally tumble with a crash which jars the hills like the mingling of heavy artillery in the battle. Coming nearer, the scene which meets the eye makes the brain reel. A tumultuous ocean of flame seems rolling over the hills, leaving nothing but smoking ruin behind its thundering march. For a while perhaps the flame moves on evenly and regularly. Presently it is lashed to fury by the breeze and leaps ahead in long tongues of flame with the speed of a courser. Again as it sweeps up the ascent of a hill and gains the top, it will seem to leap away from the earth and try to seize the sky itself in its embrace. Occasionally as it meets a bunch of cane standing erect, or seizes on the dry bark of some tree it will be seen wreathing itself in columns forty or fifty feet in height and playing among the topmost limbs of the forest—making altogether, with the deafening noise—the vaulting flame—the dense clouds of black smoke—and the cinders which fall in showers behind it—one of the most sublime exhibitions of the power of the great element, fire, which we ever beheld.

After such a conflagration has passed over the land, as may be supposed, not a green thing is seen. The ground is left clean and mellow, with a fine dressing of ashes, and nearly every tree completely deadened. Cutting the cane and burning it off in this way, is the universal method of clearing in the cane regions; and the process leaves the ground in so fine a state that superior crops of corn are sometimes raised with no other labor than to stick holes with a stick where the corn is to be planted—covering with the foot and afterwards knocking down the *mutton* cane which will spring up from the old roots.

The manner of the growth of cane from the seed is peculiar. In the fall which followed the general seeding in 1830, the ground became covered with the young plants from the seed which had fallen and been neglected by the hogs. They came up fine and tender, very much resembling nimble-will grass; and stock grazed it with great eagerness. It continued green through the winter though it did not grow; and where the land was not burnt off as we have described above, and the stock was not plentiful enough to extirpate it, the cane again took possession of the soil. The peculiarity of its growth is in this: no stalk grows, no matter how long it may stand, more than it grows the first season it sprouts. It shoots up to its full size in a few weeks, and there remains till it dies. The roots however continue growing from year to year until they reach perfection, and as all the stalks after the first year shoot from the joints of the roots, so as they advance in growth, they send up every year larger and larger stalks until at last the *mutton* cane is seen to sprout up as large as a man's wrist and attain the full height and perfection of the plant. It is many years—some 8 or 10—before the roots attain their full growth and send up the full sized cane. The first year, from the seed, the plant does not grow higher than six inches—there it stands and grows no more. The next year suckers spring up from the roots of this first plant about the size of a goose quill and about 18 inches high—there *they* stand and grow no more. The following year still larger suckers spring up; and so on until the large mutton cane are sent up—which shoot forth to full size and height in a few weeks, and these stand until seed time again rolls round, and they bear their fruit and perish. Asparagus is the only other plant with which we are acquainted which has a similar growth.

We have heard a great many pronounce as to the length of the periods at which cane will seed. Some say, it will spring up, attain its growth and seed in 7 years—others that it will only seed every 14 years. Our own opinion is that both periods are too short, and that at least 20 years will elapse before the plants from the seed will in their turn produce. The cane from the seed of 1830 has not yet after 12 years attained the full size of its predecessors, in those parts of the country where it has been left unmolested; and we have never heard our oldest citizens speak of witnessing but one general seeding—that of 1830. Partial seeding however may be seen in nearly every cane break much oftener. A few clumps—sometimes several acres will run to seed, die and fall. These are no doubt bunches which did not seed with the balance and run their course out of the general order. A few dwarf cane too—about the height of a man's waist—may be frequently seen seeding in the midst of the larger growth. The exemption of most of the bottoms, on this and the other side of the Mississippi, from the general seeding of 1830 may be accounted for from the fact that overflows kill cane—and that which stood at that time in these bottoms was not probably of the same age as that on the hills. The overflow of '28 killed large bodies of cane and on lands habitually overflowed cane will not grow. On much of the ground where the cane was killed in '28 it has again sprung up from seed which either had laid dormant in the soil, or had been floated and deposited there by the water from other sections. As late as '35, when we were last to to any extent through the swamps of the Mis-

sissippi, the cane on land where it had been killed in '28 had not yet attained any thing like full size, even though it had been exempt from subsequent overflow; and the difference in the size of the cane was an unerring index by which to judge of such lands as the overflow of '28 had left uninjured.

The first feeling on contemplating the history of this singular though common plant is surprise that none of our planters have taken the pains of securing the seed and laying down pastures in cane. We take great pains to secure clover and other grasses of precarious growth among us, and have neglected this indigenous, hardy and perennial plant which we will venture to assert will sustain more stock to a given amount of ground than any grass we can cultivate. It is equally valuable at all seasons of the year. In spring and summer the young *mutton* cane, as they are called, which spring up as tender as asparagus and as quick, furnish a sweet and nutritious food which sheep, cattle, hogs and horses seek and devour with eagerness. And in winter, when nearly every thing else has disappeared, the cane continuing green furnishes a plentiful if not a very rich supply. Cane that is grazed from will not grow up to the usual height, but the plants as they sprout will cease growing where they are bitten off, and bunching out, form what is called switch cane, being the best for pasturing, as the higher growth is beyond reach. Most of our medium lands would grow cane, which, to follow the dictates of nature, should be sowed in the fall after the land is broken up perfectly loose.

Those acquainted with any section of the country where the cane is seeding, will doubtless confer a favor on the public by making it known, so as to enable those wishing seed to procure it.

THE FARM AND FARMING OF THE REV. J. H. TURNER.—NO. V.

Remarks on lime as manure. (a.)

For the Farmers' Register.

In one of my late communications I incidentally adverted to lime, and its use as an improver of the soil, and promised to resume the subject at some future time. This promise I now propose to redeem. And this I do rather with the view of *seeking* instruction than of imparting it. In fact, I enter on this subject with very great diffidence. What I have thus far written has been the result, for the most part, of my own experience and observation. Thus supported, I felt myself warranted in speaking in terms of confidence. But when *lime* becomes the subject of inquiry, I candidly confess my want of information, and give notice beforehand that I must rely more than I wish upon that too fruitful source of argument called *theory*.

It is true that I have made *some* use of lime, and on more than one occasion; and it is equally true, that I was most sadly mortified and disappointed in the expected results. Two of my near neighbors, A. Robinson jr. and F. Staples, esqs., as I before intimated, both used lime with no better success. But in all these cases, the quantity used was too small, and the experiments made too few, to warrant any thing like a general conclusion. I am not therefore prepared, with my few and imperfect experiments, to resist the immense mass of evidence which may be adduced on the other side of this question.

A few years ago I enjoyed the pleasure of passing through the luxuriant part of Pennsylvania embracing the rich counties of York and Lancaster. Almost every field I saw indicated the highest degree of improvement. The clover, the wheat, the corn exhibited a dark luxuriant hue, which plainly told the great fertility of the soil. I inquired into the cause of the beautiful scene which was every where spread before me, and in all instances received the same answer—the mighty agent was *lime*, which had converted that whole country into a lovely garden spot.

In addition to this, the editor tells us of the great and salutary changes which have taken place in Prince George, in Charles City, in James City, and in several other counties in eastern Virginia, all resulting from the same cause. Then we have the testimony of Dr. Braxton of King William, and of the Messrs. Wickham of Hanover, and of many other judicious farmers in other portions of our state, all tending to substantiate the same general result. With this overwhelming mass of evidence before me, I cannot withhold my assent, that lime is in some form or other a most excellent improver.

It is also worthy of remark, that wherever lime exists in a natural state, a foundation is at once laid for improvement to almost unlimited extent. It is this that has made the country around Lexington, in Kentucky, the lovely spot that it is. The hand of skill and industry is the only thing needed to convert the whole valley of Virginia into one lovely garden spot. Indeed, where the foundation is a lime-stone, *skill* may be in a great measure dispensed with; the chief things necessary are industry and patient perseverance. (*b.*)

But there are many other sections of country in which this important ingredient does not exist in a natural state. Here too is an almost endless variety of soils, differing from one another in nearly every essential quality. Some are silicious, others argillacious, and others again mixtures of both in various degrees. Some have a clay foundation, others a hard pan foundation, and others again are so unfortunate as to have no foundation at all. Now, it cannot be conceived that the same material which is profitable to one must necessarily be profitable to all. We cannot admit the Thomsonian principle, that the medicine which causes one disease, will also cure its opposite. Hence results the absolute necessity of that skill which grows out of a long course of close observation and careful experiment. And hence we may account for the fact, that in the use of lime, so many mistakes have been made, and so many disappointments have ensued. (*c.*)

Nor ought it to be forgotten, that this article, which is so useful in some circumstances, is positively injurious in others. It either cures or kills the patient. We can never administer it on the principle, that if it does no good, it will do no harm. Lime is in its very nature so caustic and active, that it will always act either for good or for evil. It is therefore an exceedingly dangerous article in the hands of the injudicious and

inexperienced. As intimated in a former number, the writer, with others, has already been injured by it. Hence the great necessity of a close and intimate acquaintance with this whole matter, before we tamper with an article so dangerous. (*d.*) As a mortified and disappointed farmer, then, I do hereby call on those who are now reaping the rich harvest of their successful enterprises, to come forward and tell me and the public the whole secret of their success. And as I have reason to fear that the farmers will do on this, as they have done on many similar occasions, put off the thing from time to time, until it will never be done, I do in my own name, and in the name of many others, call particularly on the editor to take this matter in hand once more, and to give us the result of his long and intimate acquaintance with this subject. In common with many others, I hereby record my great and lasting obligations for what the editor has already done; but he will allow me to say, that his previous communications have dealt too much in mere *generals*. Being intimate with the subject himself, he has fallen into the error, too common among writers, of supposing that his readers also had some acquaintance with the subject. Whereas many, if not most of us, are still profoundly ignorant, and thus venturing in the dark, have sustained considerable injury. What we seek for then is not *generals*, but *particulars*. And that the editor may be at no loss to know on what points we wish to be informed, I will here state a few of them. We wish particularly to know,

1st. What kind of land lime specially benefits. Whether silicious, or argillacious, or a loam? (*e.*)

2d. What kind of a sub-soil it ought to have. Whether a red or white clay, or hard pan? (*f.*)

3d. What proportion is proper to the acre on each kind.

4th. In what state it ought to be applied. Whether caustic or mild? (*g.*)

5th. What is the most suitable time to make the application.

6th. On which can most reliance be placed, on stone-lime, on shells, or on marl?

7th. Ought the applicatien to be made as a top-dressing, or immediately covered?

8th. What crops are most benefited by it, and what crop ought immediately to follow the application?

9th. At what intervals ought the process to be repeated? (*h.*)

10th. Is it ever safe to apply it to poor naked land? (*i.*)

I have stated these queries just as they occurred to my own mind, without any reference to order, and I should be very thankful for a minute answer to each of them.

Having now professed my ignorance of this whole subject, it may seem strange to say, that I have any theory at all about it. But the fact is, I have experimented a little, and, with the aid of observation, reading and thought, have ventured to form my own theory; and, as it differs somewhat from any I have seen, I will frankly detail it.

According to the best information I have been able to obtain, the use of lime as an improver has been of recent date. Virgil, in his Georgics, and other Roman writers on agriculture, as far as I recollect, make no mention of it in this respect. About forty years ago, Sir Humphry Davy established his experimental farm in England. Previous to this but little wheat was raised in that country. Their supplies were derived, for the most part, from other portions of the world. Indeed, the opinion was very general that wheat could not be raised advantageously in that country. In this state of things, Sir Humphry, among his other experiments, after applying lime to his particular soil, succeeded in raising fine crops of this grain; from which he drew the general conclusion that lime was the great desideratum, and that the soil of England would produce wheat when supplied with this article. With this high authority before them, the farmers of that country generally resorted to the use of lime, and, whether it is owing to this cause, or to other sources of improvement, the fact is, that England has become one of the best wheat growing countries, so that it now produces a large proportion of its needful supplies. (*j.*) But it is worthy of remark, that the ardor which once prevailed on this subject seems now, in a great measure, to have subsided. We constantly hear much said about other and newer manures, but we hear but little said about lime. From this I conclude, that lime with them has pretty well had its day—the whole energies of this enterprising people being now directed to other materials, which are probably destined in their time to be superseded by something newer, and therefore still better. (*k.*)

How long lime has been used in *this* country, and *where* its use commenced, I frankly confess my ignorance; but, if I am not greatly mistaken, its general use in Virginia commenced *after* the publication of the editor's 'Essay on Calcareous Manures.' And here, without intending any compliment to Mr. Ruffin, I consider it but sheer justice to say, that to him we are indebted for most, if not all, the benefits which have resulted from the use of this article. After expressing myself as above, it may seem strange that I should wish to impose on him still more trouble. It is simply because I like what he has written so well, that I wish him to write more, in which new effort I hope he will not deal with us as having taken our diploma in this art, but will condescend to treat us as A B C scholars.

There is, however, one term frequently occurring in the above treatise, and often repeated in almost every subsequent treatise, to which, if I understand it aright, I must offer my unqualified protest. The term alluded to is, that lime is specially useful in *fixing* the manures in the soil. The old theory was, that lime was not an enricher, but acted as a stimulant, powerfully urging vegetation to seek and to appropriate to itself all the nutriment that might be in its reach. This theory seems to be now very generally exploded, and in lieu of it, we are told that its special use is in *fixing* the manures in the soil. Now what is the meaning of this word *fixing?* Are we to understand by it, as it seems naturally to import, that, by applications of lime, manures are made more permanent and durable, and thus actually last longer? (*l.*) If this be the meaning, the editor and I, and all others who understand the thing in this way, must join issue. For what is lime? And here, without attempting a chemical analysis of this substance, it will answer my present purpose

to say that, in its very nature, it is a strong caustic alkali, the natural and direct tendency of which is to reduce to their original elements all the substances, both animal and vegetable, to which it is applied. Lime, for instance, finds substances in a solid or liquid state. It changes them from this into the aeriform state, and then they pass off in the form of their various gases. Hence its great efficacy as a cleanser of stercoraries, and other offensive collections of decaying matter. The ammonia is speedily driven off, and the residuum is left in a sweet and harmless state. If then this be the direct tendency of lime, it seems to me to be the very last thing to make manures more permanent. Instead of *fixing* them in the soil, it decomposes them, and the gases being set at liberty, will make their escape.

Now whilst stating the above, I readily admit that applications of lime to coarse unfermented manures, may be of very great service. (*m.*) Manures in this state decompose very slowly. It is also of very great service to lands filled with turf and other vegetable matter, in an inert state. Such manures commonly decompose very slowly. If they evolve their gases at all, they do it so slowly as to furnish very little nutriment to growing vegetation. Hence it is that no judicious farmer expects much *immediate* benefit from applications of coarse materials from his farm-pen, or from dry straw or dry litter from the woods. It is now pretty well ascertained, that it is the *gases*, and the gases alone, which nourish our crops, and that these are evolved only during actual decomposition. Now, with manures of this kind, lime must be very useful. It hastens a process which would otherwise be slow, and the crop being already on the land, takes up the gases as they are set at liberty, and thus receives benefit. It is in this way that I account for the fact that in the few applications of lime I have made, one was successful, the others were mortifying failures. The successful application was on land newly cleared, covered with litter, and filled with small fibrous roots. Here the lime had vegetable matter to act upon, and the growing crop derived the benefit from the rapid decomposition, which the lime caused it to undergo. In the other instances, the land was naked, or nearly so, and the lime having nothing to act upon, no gases were evolved, and consequently no food was furnished to the crop; and as might naturally be expected, the whole affair, expenses, labor and all, terminated in a "splendid failure." I would not therefore hesitate to recommend considerable applications of lime to forests to be speedily cleared, or even to old fields pretty thickly covered with young pines, which it is intended to reclaim. Then I would leave the brush and other litter, for at least one year; after which, I should expect to bring the land into successful cultivation, not by *fixing* these materials in the soil, but by subjecting them to a rapid decomposition, and thus (if I may be allowed the expression,) *unfixing* them.

But perhaps the editor and other writers who are fond of this term *fixing*, may mean something else. They may mean that lime, where manure or other vegetable matter already exists in some form, does, by rapidly decomposing the same, saturate the soil with fertilizing gases, and thus impart a vigor which will enable it to throw up a strong crop of vegetation, which, falling and decaying on the land, will not only keep it in good heart, but actually improve it. In this way the original manure has not been fixed or made permanent, but it has imparted to the land a vigor and fertility which enabled it to cover itself with a strong crop of vegetation, and this, in its turn, decaying on the land, makes that fertility permanent. If this be the meaning, I give it my hearty concurrence; and thus it falls in with my theory on which I slightly touched in one of my former numbers. But then it ought to be borne in mind, that lime does not make the manure *permanent;* it merely hastens that process by which the manure is changed from an inactive to an active state, and then a permanency of fertility is insured by successive crops of vigorous vegetation. Instead, therefore, of the lime *fixing* the manure, the manure is fixed by means of successive crops of vegetation, which constantly rising up and then decaying on the land, make fertility permanent. It is these constant additions and accumulations of manure which can by any possibility fix or make them lasting. The idea therefore I wish to convey is simply this, that no applications of lime on a previous manuring can so fix that manure as to render subsequent manurings unnecessary. On the other hand, if the crops be removed and no equivalent be returned, the land will constantly decline, so that, instead of *fixing* the manure in the soil, we shall fix something there which we will find infinitely worse. (*n.*)

Or perhaps the meaning of this term may be that lime is specially useful in neutralizing or destroying that principle in *acid* lands, which seems to render applications of manure to such lands almost useless. Now I pretend not to say what that principle is. It may be acidity itself, or it may be something else which always abounds in acid lands. But be it what it may, there is something in such lands, as every observant farmer well knows, which seems to dissipate and scatter to the four winds his manure, almost as fast as he applies it. The whole fertilizing effects of the manure seem to be exhausted upon one single crop, so that the land is almost as poor at the end of the year as it was at the beginning. I have some such land, and I have often wished it was in the moon, or any where else out of my sight. It cost me just as much as the best land I own, and I hereby offer to *give* it to any one who will take it away, so that it may never harass my sight or purse any more. (*o.*)

Some persons are of the opinion that manure *sinks* in such land. But I cannot think this correct, for, on examination, I find that if it have any foundation at all, it is a hard pan so obdurate that it can scarcely be penetrated, even with the pickaxe. This being the case, I cannot admit the idea that the manure *sinks*. I rather incline to the opinion that the manure is dissipated, and thus rises up and goes off, not in the form of ammonia, but of some other gases which do not nourish vegetation. But be this as it may, a question of much more importance is, how is this evil to be remedied? Can this malady be cured by lime? Or is it to be ranked with cancer, consumption, and other incurable diseases which afflict the human body?

But we often meet with acid lands, which are not imbedded on a hard-pan substratum. Most

of our high-lands, where pine is the prevailing growth, are of this description. Here the soil is generally of a light silicious character; and here lime, judiciously applied, I doubt not, is very beneficial in rendering the manures permanent. The great desideratum here is something to neutralize the acid, and as it is well known, that alkalics will have this effect, lime, next to manure, must be the "one thing needful."

One word as to the discussion which has been going on for a short time between Mr. Nicol and myself. The editor, in the last number of the Register, calls it a "*controversy*," and seems to intimate that it has been carried on with unkind feelings. Now to this term, and to this insinuation, so far as I am concerned, I enter my solemn protest. I never entertained one unkind feeling towards Mr. Nicol; and judging from what appears in his "rejoinder," I would think that his feelings are as kind and respectful towards me. The truth is, that when I wrote my piece, I mistook my man. His communication was dated "Sandy Point," and from his frequent reference to the same place, I naturally supposed that he was the proprietor of that great estate. As such I prepared a dish into which I threw some salt. * * * * * * * * In fact, I made it a pretty pungent affair. But then this mess was not intended for Mr. Nicol. * * * Had I known or even suspected that Mr. Nicol was the worthy manager and not the proprietor of that great estate, my bill of fare, if I had furnished any at all, would have been of a very different order. I now not only know who Mr. Nicol is, but have had the pleasure of seeing him at the late meeting of our Agricultural Society. I was exceedingly busy on that day, so much so that I could only give him a cordial shake of the hand, intending to intimate that I had no unkind feeling towards him, and if he had any towards me, I verily believe that I *shook* it out of him. So that we are now better friends than we ever were before.

But I must say one word to the editor. He says, he has pruned both of us. How much he pruned Mr. Nicol, I cannot tell; but he has pruned me so close as to leave almost nothing but the stump. Finding, as he supposed, too much salt and other seasoning in my dish, he undertook to take it out, and in so doing, he will allow me to say, he has pretty nearly verified the old saying, that "too many cooks spoil the broth." If therefore he will allow me to "shoot no more bolts," he will in his turn be very careful as to the criticisms which he admits on my anonymous essays. I feel just as tenderly for my brats *without* a name as *with* a name.

J. H. Turner.

Notes by the Editor.

(*a.*) It has never been our usage, nor inclination, to exercise the almost universally assumed editorial privilege of replying to opponents in advance of the publication of the pieces so answered; nor even to answer by appended notes, as will be done here, and has been done in a few former cases when, like this, it was manifestly more convenient and better for the clear understanding of both sides to take that course. In the present case, the manner of the call made upon us, and our respect for the source from which it proceeds, both forbid us to neglect it, and pass it by silently. And yet, if it were attempted to answer the call fully, and in a separate and substantive article, it would be necessary to quote and repeat the many questions, and state at length the many objections or difficulties to be replied to, so that the reply could not be otherwise than very voluminous and tedious. Therefore, to save time and words, we shall take the liberty of appending in notes, at the end of the communication, the particular answers or remarks that may seem necessary—and will refer to other accessible sources for the more full information which may still be wanting, notwithstanding these notes.

The ground of discussion now presented by our correspondent is altogether different from what we had asked for and expected. We had requested (at page 154,) a statement of the particulars of his own applications of lime, which had totally failed of effect, (really or apparently;) and we had hoped to be able to find out from such statement of particulars, and to point out, the causes of the failures. But instead of our being permitted to pursue that course, and perhaps to occupy something of *new* ground on this subject, Mr. Turner has gone more upon theoretical views than practical matters, and has required many answers and reasons which had been (as we had supposed) already presented by us at sufficient length, and with sufficient clearness, in previous publications—and which, if repeated here, would be a long and wearisome task. For one question put to him, he has answered by asking twenty more. In some respects, if not all, to which the foregoing observations may apply, our esteemed correspondent must pardon us for expressing the doubt whether the fault which causes the necessity of further explanation to him of our views be not more in his own slight attention heretofore given, rather than of our want of fulness and explicitness in former statements. However, be that as it may, we desire above all things to be as plain and as clear and intelligible as possible in all writings upon agriculture; and we will bear in mind these our friend's difficulties and objections, as well as any others known, and endeavor to remove some of them, hereafter, by using still greater care in preparing the next edition of the essay to which he has referred in such kind and gratifying terms of general commendation. The publication of such an edition, en-

larged and increased in value no less than in bulk by the addition of more recent lights and later experience, is designed to be commenced some time within this year; and in the appropriate parts, whether of reasoning or of statements of practice, the alleged existing defects of sufficient fulness or particularity will be had regard to, and supplied when deemed requisite. Referring then to the last edition of the "Essay on Calcareous Manures," or, when that is really deficient, to the next forthcoming, for whatever may he here omitted, we will proceed to give such answers on particular points as may appear necessary.

(*b.*) In the preceding paragraphs, the writer seems to have withdrawn his previous denial (as we understood it) of the general benefit of and general necessity for calcareous manures on soils; and to become their eulogist in as general and as strong terms as we should be disposed to use. But still we would desire to bring back the discussion to the ground on which it was raised, viz.: the particular facts of the failure of Mr. Turner and some of his neighbors (in some or most cases of trial) to obtain any benefit from liming. We were before sure that Mr. Turner did not entertain the slightest doubt of the facts of success alleged by the several individuals to whose practice he has now particularly referred; and we are just as far from doubting his failures, or the occurrence of such facts in his practice as served to form his belief of his applications being failures. But the business is not to defer to authority, no matter how good, but to try to reconcile these apparently opposing facts and results, by presenting all the circumstances of both modes of trial. This we have aimed to do, in former publications, and at great length, as to *our* results, both successful and unsuccessful, and will add any deficient particulars that may be hereafter required. In regard to the opposite results of Mr. Turner, the circumstances are stated so slightly and so generally, that it may be presumptuous for us even to pretend to judge of the causes of their failure; but nevertheless such causes as seem probably to have operated, and such reasons as seem to apply, will be mentioned.

We understand from the former concise and general statement and present repetition of Mr. Turner, merely that he (and two of his neighbors also) applied lime to soils almost naked and barren, and found no effect or benefit whatever therefrom. Now, though we believe that there was a great mistake as to there being *no effect* ultimately produced, still we would freely admit, (and it would be precisely what we would have anticipated and predicted of such an application, and such circumstances,) that there would be no early and obvious improvement—perhaps not enough to be distinguishable, and certainly not enough to be profitable, without putrescent matters being also applied at the same time, or afterwards. The great and most beneficial operation of calcareous earth as manure is to combine chemically with putrescent manure, or any matters serving to feed plants, and thereby "*fix*" in the soil these otherwise fleeting and wasting matters. If there were no such enriching or alimentary matter in the soil, of course no such beneficial *fixing* action of lime could take place—and on an exceedingly barren soil, exhausted by tillage and close grazing to the lowest possible degree, this action might be so little as not to be perceptible. Nearly all our own practice and earlier cultivation have been on originally bad soils and very poor and exhausted lands; but excepting the numerous and extensive galls of the washed slopes and hill-sides, we had no experience of land so excessively poor as Mr. Turner described his to have been when he commenced operations, and when (as is presumed) he applied the lime. But even though no early benefit from applying marl or lime be *seen* when applied to naked galls, or to other almost as barren land, the application would give to such land the power of combining with, holding, and thereby receiving benefit from, putrescent manures (or any vegetable matter) afterwards to be applied. Now we presume (in the absence of any express statement) that this land so limed by Mr. Turner, without benefit as he supposed, has been since heavily and repeatedly dressed by putrescent manure, and, like his land generally, has been highly improved by such lavish manuring. Now suppose that the small quantity of lime before applied has actually and fully performed its office of *fixing* in the soil as much of the alimentary matter since given as it could combine with, this small effect, however valuable in proportion to its extent, would be lost and invisible, amidst the ten-fold greater quantity of putrescent matter applied every three years, and which was, as *we infer*, mostly wasted for want of lime to combine with. According to a previous statement of Mr. Turner's, (p. 151, 2,) he found his applications of putrescent manures, (much of it rich manure from town stables, 1250 bushels to the acre,) to show "an evident falling off in the second, and especially in the third and fourth crops [or years.] This madea second manuring necessary; and," he adds, "I am now convinced that excessively poor lands, such as mine were, cannot be made permanently rich under *three* distinct manur-

ings." For our part, we suspect that *thrice three* such manurings (of putrescent matter alone) will not be *permanent*, without lime applied in some manner (*and coal ashes* is one, though a feeble source of supply,) is given to the land also. Now, according to our view, if a sufficient dose of *mild* lime had been given *before* the first putrescent manuring, even although the benefit of the lime had not been distinguishable at first, nor appreciated since, it would have caused two of the manurings to be as serviceable as the three, up to this time, and much more in all future time. And if this view and opinion were admitted to be true to the fullest extent, still it will be manifest to the reader, inasmuch as such effects are merely *preservative*, and where other far more immediate and active manures are lavishly applied afterwards, and repeated in rapid succession, that the effects really due to the lime might not be known and appreciated, or if seen at all, would be ascribed to other causes. Especially would this be the case, when the true action of lime in soil was not understood, or such benefits from it are expected as are produced by putrescent and alimentary manures.

But in our own practice, the "fixing" and preservative power of lime was had in view, and such effects looked for; and such as was our own poor and bad land, (and poor and bad enough it was,) we have never made an application of marl thereon that was not both effective and profitable; nor even on a naked gall, which was not effective in improving it, by fixing other and alimentary manures, (if such were added in any manner,) though perhaps such improvement of galls might sometimes cost more than the land was worth after the highest improvement thereof.

We do not, however, pretend to set forth our own limited experience of results, in a particular locality, as indicating precisely such as are to be expected in other localities, where other and unknown conditions of soil may exist. And we are ready to admit, in advance, that there is existing a difference of circumstances, of which the causes are unknown to us, in soils above and below the granite range, or falls of the rivers, though of like texture and general appearance. And we have inferred, as different effects of this unknown difference of causes, that gypsum is more generally active and useful on lands above the falls than below; and lime and calcareous manures generally more effective and profitable below the falls than on lands of similar appearance above. On this interesting question, many facts and proofs are wanting. And, to gather all the light desired, the advocates of either of these manures, generally, should not insist that their rule of action, however good for themselves, is of universal application; but should also examine for, and give all due weight to, the real or apparent exceptions to be found elsewhere. We freely acknowledge that we are much in the dark on this as on many other particular points of this general and extensive subject for investigation.

But Mr. Turner admits the propriety, and probable profit, of liming his land, *after* he has or shall have applied three successive heavy dressings of putrescent manures, at intervals of three years each. But it would have been far better to have applied the lime before. The full comparison of our views and statements would bring us both nearly to one point of agreement in this respect. The only remaining difference seems to be, that, while we recommend making ready and applying the *preserver* before exposing to waste and loss the thing desired to be preserved, Mr. Turner's opinion and designed practice would reverse the order, and furnish the means for preservation 3 to 9 years after the putrescent manure had been applied, and during all which time, by his own showing, it had been rapidly wasting. The putrescent manure he most correctly regards as his great treasure. The calcareous matter in soil, or to be applied to soils, where not existing, is the *lock* on that treasure. Is it then most judicious and economical, to furnish the lock *before* there is yet any treasure to secure, or to wait until after it has been for years in a state of daily extraction and waste?

(c.) It is very far from being the fact, that the same prescription of lime for soil is made for opposite diseases. The disease is *one*, though there may be some variation of minor symptoms according to difference of the constitution and previous treatment of the patient—and that disease is the great deficiency of lime, without which in sufficient quantity no soil can be good. In charging upon these soils the cause of their worthlessness, the allegation must be of what is *absent*, and not what is *present*. We had the misfortune, within the last few hours, to be compelled to hear the speech of a very windy and magniloquent member of the bar, who in referring to the baseness of an individual whose case and character were in question, said that "he was brim-full, to overflowing, with the total want of all moral rectitude." Now all these bad lands, however various and numerous their vices and defects, are all "brim-full, and to overflowing, with the (almost) total want of" *lime*. Therefore, the disease, or the foundation of the complication

of diseases, being one and the same, there is no quackery in prescribing one remedy as essential for all.

(*d.*) In the "Essay on Calcareous Manures," the author particularly, as well as *generally*, stated that the carbonate of lime, or *mild* lime, (as presented in marl,) was what he had almost exclusively operated with, and to the operation of which his theory and rules applied. *Caustic* or quick-lime was particularly excepted, though a particular consideration was given to that important exception, (See Essay on Calcareous Manures, 2d edition, pages 32 to 35.) The *only* condition of soil for which we there recommended *caustic* lime, or even thought its use allowable, was that of newly cleared or fresh land, full of vegetable matter; and it was in precisely such a case that Mr. Turner found decided benefit and profit from the application. In all other cases, (and we would not insist even on that one exception being requisite,) we would prefer to have the lime *carbonated* or rendered mild, by exposure and absorbing and recombining with carbonic acid. This end will be sufficiently secured by the mode of application introduced by the late Fielding Lewis, and which was described in no. 1, vol. i., Farmers' Register, and is in general use on the lower James river, wherever lime is applied. Any other mode of sufficient exposure to the atmosphere, that would reach the same end, would as fully guard against all the danger feared from the *causticity* of lime. And wherever such evils have been suffered, we must be permitted to say that they have not only *not* been attributable to our published instructions and advice, or the want of stating exceptions, but in direct opposition to both our general views and particular statements. If all the persons who suppose they have suffered injury from the too general opinions or incorrect instructions in the 'Essay on Calcareous Manures,' were examined as to the grounds of their charges, we suspect that it would appear that nineteen in twenty of them had not so much as read the work.

(*e.*) Liming, (in the sense stated in the last note,) operates more quickly and fully (for the first crop,) on silicious or sandy, than on clayey and stiff soils; but beneficially and profitably on all grades of texture of soil, if deficient in lime, as a natural constituent.

(*f.*) We care nothing about the subsoil, provided it be not *wet*, which bad quality is indeed an effectual bar to improvement by lime, as well as by every other known manure. We had some little red and more of white clay sub-soil; but most of ours was barren yellow sand sub-soil, generally deemed the worst of all; and on land having this very base sub-soil, our improvements by marl have been the most striking and most profitable. This is the kind of sub-soil, we infer, that Mr. Turner speaks of as of land having "no foundation at all." We would desire no better foundation for improvement by calcareous manures.

(*g.*) In giving the following particular answers as required, to particular questions, we must repeat, and beg that it may be borne in mind, that we have almost no personal experience of *caustic* lime as manure, and do not approve its use, unless in some very few cases; and, except when especially and expressly referring to *caustic* lime, that our remarks will here apply, as heretofore, to the *carbonate of lime*, whether as presented naturally in marl, or by burnt lime, after becoming mild by exposure.

(*h.*) Some portion of the questions, from 3d to 9th inclusive, have been already answered in the preceding remarks, and all of them susceptible of being precisely answered, as we conceive, in the report of Fielding Lewis' farming (above referred to,) and in the 'Essay on Calcareous Manures.' And to answer fully here, would require 20 more pages of addition to these notes. In regard to burnt lime, (though that always becomes very soon carbonated in the usual practice of exposure, and before the first crop begins to grow,) some more full and valuable information is also presented in a preceding article, respecting the liming on Brandon, (page 279.) As it respects the *kind* of lime, provided it be but rendered mild, we should care very little as to what source it was derived from. Whether found in marl, or new or mild burnt lime, and whether from stone or shells, the only important consideration is, of which kind can a dollar's worth of labor and money furnish to the land the greatest number of pounds of *carbonate of lime*.

(*i.*) It is always "*safe* to apply it to poor naked land"—if it be *mild* lime, and not in excessive quantity for the circumstances of the land.

(*j.*) We would by no means concur in the several opinions and statements expressed in the preceding parts of this paragraph; but it is unnecessary to object to them, as they do not affect our positions. It is enough that we agree with our correspondent in his last stated position, that lime has generally been used in Britain, (where needed and accessible, we would add,) and that the greatly improved production of that country "is due to this cause, or to other sources of improvement." We would only desire to substitute the word *and* for the "or" above—giving to lime

the credit of a large part, but only a part, of the great agricultural improvement of England, and still more of Scotland.

(*k.*) We might well afford to concur in the opinion expressed, that lime in England "has had its day," but in a different sense from what is above intended. Lime *has* "had its day," indeed; that is, it has performed all its proper service, wherever it has been fully and sufficiently applied to give the needed change of constitution to the soil, and still to leave enough excess of lime to combine with and fix any early expected additional supplies of putrescent manures or other alimentary matter. In this sense, marl also "has had its day" on some farms we know of in Virginia, and the use there has been discontinued for some years. But it was only discontinued because all the surface had been fully marled; and other manures have been since sought to be applied, in preference, and almost exclusively, because these manures, vegetable and animal, are now highly profitable. Still the benefits at first derived from the marl continue and increase with every year. No advocate for the use of calcareous manures, who knew any thing of their true operation, has recommended their continued repetition—or their being substituted for putrescent, or for all other manures. In our own case, we have not only almost ceased to supply marl (for the above reason,) but have become as ardent as is Mr. Turner for applying putrescent manures on the lands where the marl "has had its day," and where, before marling, the application of putrescent manures was almost labor and expense thrown away.

(*l.*) Precisely—such is the *effect* of what we have termed the power of calcareous earth of "fixing" putrescent manures—and the mode of that operation, we maintain, is that the calcareous earth forms a chemical combination with both the soil and the putrescent manure, and thus retains the manure, and makes it permanent, until and except so far as the superior power of growing plants shall withdraw the putrescent manure for their sustenance from that combination. As we have never ascribed this power to the causticity of quick-lime, nor advocated lime while in a caustic state for this operation, all Mr. Turner's objections to caustic lime on this score might be admitted, without affecting in the least our position in regard to the "fixing" property of mild lime.

(*m.*) *We should* object to the mixing of caustic lime with even the coarsest of manures, if they had any rich and very putrescent matter intermixed—for to such matter the contact of caustic lime is always injurious, in the manner which Mr. Turner has correctly stated.

(*n.*) Having before stated what we meant by the term and the operation of the "fixing" of manure, by calcareous earth, it is not necessary to say any thing farther in regard to any mistaken inferences of our meaning. One small exception however it may not be improper to express, which is to state that we certainly *did not* mean to maintain the position, which Mr. Turner here opposes, that any "applications of lime on a previous manuring can so *fix* that manure as to render subsequent manurings unnecessary." He who would assert such doctrine, and as founded on his own practical experience, would deserve no respect for any other opinions, either in reference to his judgment or his veracity. In the first case, lime, (meaning *mild* lime,) applied *on* a previous cover of putrescent manure, and which was of course passing off in more or less waste, could not possibly be thoroughly intermixed and combined with the manure, so as to stop the waste, or to retain as much as the *amount* of lime under more favorable circumstances might combine with. This effect would be much better produced by the lime having been made the *first* application even to "dead land," and so thoroughly incorporated with it, that the manure would meet lime every where. But even that would not serve, except so far as the quantities of the calcareous and the putrescent manures were in proportions suitable to combine with each other. If the lime given to an acre be sufficient to combine with and fix and save only 100 bushels of putrescent manure, and 1000 be put on, the 100 may be saved, but 900 will be lost as surely and as quickly as if no lime had been applied. But even that amount of putrescent manure, and its fertilizing action, which the lime in a soil *could* fix and retain under a lenient and judicious course of tillage and rotation, (whether it be equal to 100 or 1,000 bushels of stable manure to the acre,) certainly will, in time, be drawn from the soil by the crop, if under severe and continued tillage, and removal of all the growth. And so (though it may require a long time and much trouble) may the best natural soils, such as were limed by the hand of the Creator, be also exhausted and reduced to poverty. But even when so reduced, the fixing and recuperative power of the lime in such soils will be apparent, if any chance for recovery be allowed to the land; as it will improve rapidly, and get rich again, if but left to itself; whereas Mr. Turner's poor land, and ours, that were "born poor," would remain so for ever, if left to get rich merely by rest, and their own growth for manure. Therefore, the admission that a marled or limed soil, after being enriched, *may* be empoverished by scourging cultivation, is not a contradiction of our position of the *permanency* of the improvement made by calcareous manures, and also by putrescent manures

combined with them. It is enough for this position, that land so improved can bear any judicious and farmer-like system of cropping, in grain and grass, which gives a proper return to the soil, though taking off much more in frequent crops. Such, for example, is the Westover and Brandon four-shift rotations, of three crops of grain and one of clover in every four years; yet the land is kept *improving* under that heavy draught on its productive power, after liming, with only the manures of the farm, and gypsum. If Mr. Turner were to stop his heavy dressings from purchased manures, even after having made the land as rich as is possible without lime, how long would his land bear up, under such heavy exactions as those referred to, and retain all its previous and highest power of production?

(o.) As much as Mr. Turner would seem, in some parts of his remarks, to oppose our views in regard to lime *in the general*, he furnishes in *particular statements* the strongest confirmation of them. And here is a very remarkable case in point. There *is then some soil* that Mr. Turner's generous and even lavish and repeated triennial manurings *cannot make rich* temporarily, much less keep rich? If we were to say that the cause were wholly (as no doubt it is in part, as Mr. Turner supposes,) the acidity of such soil, (or something else,) which "seems to dissipate and scatter to the four winds his manure, almost as fast as he applies it," and lime would remove this evil, and let the manure act and remain as on other lands, it would be but presenting the "fixing" proposition in a different form. Without having seen or had any experience of any land so bad as he describes, and without entering upon the discussion of the *modus operandi*, we can venture to assert that "the something" and the whole matter with this soil, which causes such very uncommon bad qualities, *is the want of lime*. And so sure are we of this, that if we were residing in Mr. Turner's neighborhood, we would accept this land which he offers to give away, and think that we could show him that the making it calcareous would make it abundantly retentive of putrescent manure. Of course, we infer that the land so described and denounced is dry, and *has a soil*, however poor it may be. If land be wet, and remain undrained, improvement by lime, or any other means, is hopeless; and if the original soil has been washed away, or otherwise removed, though improvement would be quite feasible, it would be of more cost than profit. We presume however that Mr. Turner does not refer to any such extreme cases as these, any more than to surfaces of entire rock, or pebbles, or of blowing sand, where soil had never existed. As to all ordinary and naturally poor soils, and including the poorest of them, we entertain no doubt of their being universally susceptible of high improvement by lime; and that by using lime thereon judiciously, from one half to perhaps nine-tenths of the putrescent manures may be saved, which would be otherwise required to maintain any certain grade of increased productiveness.—Ed. Far. Reg.

REPORT TO THE STATE BOARD OF AGRICULTURE,

ON A PART OF NANSEMOND COUNTY.

Chuckatuck, May 16, 1842.

Mr. Edmund Ruffin, Corresponding Secretary of the Board of Agriculture of Virginia.—I received your communication (circular) only a few days ago, the letter having been addressed to me at Suffolk, and in compliance with the request, will answer such of the queries therein contained as come within my knowledge, though imperfectly.

My observations will be confined mostly to the land on Nansemond river and its tributaries, though they will suit the greater part of the county, except for the want of marl off the water courses, with which we abound on the banks of the river, with shell marl, or rotten oyster shells and decomposed vegetable matter, forming an almost black surface soil of 6 to 12 inches deep, the former settlements no doubt of Indians. Occasionally, on the river bank, and always on the creeks and coves, is found an abundance of marl, formed of clay and marine shells, both of which have been applied with good effect on our lands, when used with judgment; but owing to a want of knowledge of chemistry, and the caustic effects of calcareous matters, it was used so lavishly some years ago, as to render the land entirely unproductive, and will require many years to reclaim it, by rest and the use of vegetable matter, and the contents of the farm-yard. This injury is only partial, however. One field in this neighborhood was marled some eight or nine years ago, at the rate of 800 to 900 bushels per acre, the crops of which have never since paid one half the expense of cultivation; the land had been heavily cropped several years before, was worn down and naked; but in every instance, that I know of, where 100 to 150 bushels to the acre have been used, it has acted beneficially. It is difficult to overcome prejudices, and many will not use it, from the injury sustained by some by over-marling.

Most of our lands are what may be called level, and generally are so, except on the water courses there are some inequalities, produced by coves or guts running up into the fields.

The climate is vacillating, produced by our contiguity to the seaboard, generally feeling the influence of the sea breeze or easterly winds; indeed since my recollection it has changed very much, having later springs and earlier autumns, so much so as to render the cotton crop precarious, and causing the cultivation of it to be entirely abandoned.

Now, our crop is mainly corn, with peas, and oats, and potatoes, and melons, on or near the

water courses; some few cultivate wheat, though very few; but few sow grass seed, and then the preference is given to red clover, which is mostly grazed, very little cured for hay, so that our cattle have to subsist during winter on corn tops and husks, and by the spring are generally perfect Rosinantes.

The arable part of farms is generally small, 30 or 40 acres to 200, some few 300 to 400. Husbandry has been injured and retarded very much in this county, by the facilities afforded for speedily converting our labor into money, by lumber and the products of the river realizing more from an effective force, (men.) than the slow returns of agriculture on worn lands, few being able to employ such force in clearing or improving their farms. Still there has been some improvement in management by husbanding manure, by penning the cattle, and littering the pens, which is applied in the spring on the corn ground mostly in the hill, or on the sweet potato and melon crops, by those living on or near the water courses.

I may say there is no uniform system, if any system at all, in regard to the rotation of crops. The arable land is generally divided into two fields, often only one; one is cultivated always in corn, or corn and peas, the other sometimes in oats; though many are prejudiced against oats, thinking they impoverish the soil more than corn, and with such, the field lies idle or grazed until the next year, when it is planted in corn. But few have three fields, and no one more; so that you may judge the improvement is slow, if any; the greater part arises from the decay of the pea vines and the weeds and grasses, which grow after the suspension of the cultivation of the corn crop. The ploughing is generally shallow, to suit the surface soil, 3 to 4 inches deep, sometimes 5 or 6 on better or improved lands.

The land is always broken up with the plough, (Freeborn's cast-iron generally,) then checked off 4 feet square, or 5 by 3, and cultivated with the old fluke hoe plough, or three hoe harrow, commonly called the Eastern Shore harrow, as it was introduced here from thence; which keeps the land level and saves much hand labor. But few ridge, and cultivate one way only, though that system has a few advocates, and I am decidedly one of them. Some few use the double-shovel plough, which is a most effective implement, the best perhaps we have, both in execution and saving of labor, from the time the corn comes up until it is laid by.

The corn blades are always stripped from the stalks, and then the tops are cut, cured and stacked; the corn is gathered from the stalk and housed, as no small grain is to succeed it that fall.

The product per acre is about 15 bushels of corn and 10 to 15 of oats; in some instances more, often below.

Our fences are made of pine rails, crooked or worm fences as they are called, except in a few instances they are wattled or bushed, on a bank thrown up by digging a ditch; cedar boughs are generally used, driving in the banks stakes about one and a half or two feet apart, to weave in the branches, and makes, when care is taken, a very pretty and substantial fence.

Our teams are mostly horses, sometimes a mule or two, and rarely oxen; no horses are raised for sale and but few for farm supplies; calves and lambs are commonly sold in the Norfolk market, and pay better than raising beeves and mutton.

Most of our people are opposed to book farming, and of course to innovations on the old system, and denounce much of what they hear of in agricultural periodicals as humbugs, and hence arises, in a great measure, the low ebb of agriculture among us.

Nearly all the improvements made hereabouts are by those who have been readers of the American Farmer, the Farmers' Register, and the Cultivator.

I regret that I have not been able to give more interest in my reply to the queries submitted by the Board of Agriculture; my occupation is not wholly agricultural, my age too advanced, and travel too circumscribed, to give information entirely correct; if it should be worth nothing, you will of course throw it aside, or glean such parts as your judgment may prompt.

We have no agricultural society in the county, to our shame; there was one in Chuckatuck for a short time three years ago, but so little interest was taken, and but by a few, that it was given up.

I am pleased at the establishment of a Board of Agriculture, and think it calculated to do much good. Respectfully, WILLIAM SHEPERD.

REMARKS ON MR. TURNER'S THEORY ON ROTATIONS.

To the Editor of the Farmers' Register.

Big Lick, Roanoke, June 13th, 1842.

* * * Whilst I have my pen in hand, and am fresh from your Register, I will scribble what has been suggested to me by one of the pieces, which you can use your pleasure in throwing aside or publishing.

In the number to which I allude, the last, you publish the views of J. H. Turner, on rotation, without comment. Are your readers to construe silence into approval? We look to you as a guide, to conduct us along the safest path, when we are perplexed by the discordant and contradictory theories of distinguished agriculturists; and surely if there ever was an occasion when your counsel and warning were required, it was when you gave currency to the views of Mr. Turner. This gentleman, from his successful farming, his zeal for the agricultural interest, and his well written communications, has acquired a distinction which gives more than ordinary weight and influence to his opinions. Of course many, in a spirit of blind confidence, will embrace as the sound and irrefragable results of experience, whatever this practical farmer may advance, however opposed to the lights of science; unless you accompany the publication with your dissent from the errors and fallacies, in which he has involved himself, and into which he is likely, by his specious reasoning, to seduce many of his brethren.

What do you think of the leading idea of his communication, No. 4, "that a rotation of crops is unnecessary?" Is it not opposed to every opinion on this subject ever advanced by yourself? Is it not at war with every principle established by the experiments in vegetable

physiology? Is it not directly in the teeth of all that is taught us by Sir H. Davy, Chaptal, De Candolle, Liebig, Buel, and every other agricultural writer of reputation? And lastly, is it not opposed to the experience of every farmer who does not live within the smoke of a city, where the fertility of his lots may be almost maintained by the continual presence of an atmosphere loaded with gases generated by the filth of a crowded population?

It is a common observation of farmers in this quarter, that when lands are worn down with long continued and severe cropping, so that their yield in *grain* is not worth the labor of cultivation, they will produce a luxuriant crop of *clover*. Not less common is the observation, that old tobacco lots, when they grow tired of the crop which they have borne for a long succession of years, and refuse to produce the same heavily, however well cultivated or highly manured, can only be restored as a tobacco lot by a rotation. It would be easy to illustrate these opinions by many striking examples around me; but I deem it unnecessary to cumber this letter with them, as I presume there are palpable illustrations of their truth in every neighborhood in the state.

We have always thought that these results were perfectly natural, and consistent with the organic laws of vegetable physiology. We have been content with the theory, that some plants require a peculiar species of food, whilst others require a different. That, of course, when the peculiar food of the cultivated plant was exhausted, it was no longer capable of producing it, whilst its adaptation to the growth of other plants, demanding a different *pabulum*, was unaffected. We have always believed, too, that the excrementitious matters, thrown off by plants, were as incapable of nourishing plants of the same kind, as the excretions of animals are of being assimilated by the same species. We have believed, too, that the analogy is farther maintained in this, that these excretions may nourish other plants, differently constituted, as the excretions of one species of animals affords nourishment to another. Such have been the opinions of all enlightened agriculturists for a great many years: certainly ever since the theory was revived and illustrated by the genius of De Candolle. Liebig, in his great work on agricultural chemistry, maintains it, with some slight modification, in all essential particulars. He thinks that the excrementitious matters suffer various transformations in their passage through the organism of the plant, (pp. 54 and 55,) till at last, being capable of no further changes, they are separated from the system, by the organs destined for that purpose. That these exudations, though they may be absorbed, can never (until decomposed) be assimilated by the plants producing them, while they may very well be fed on by plants differently organized.

Independent of the cogent inferences from the known principles of vegetable physiology, in support of this theory, the experiments of Macaire Princep, alluded to by Liebig, seem to place its correctness above controversy. How will Mr. Turner, except upon the principles here advocated, explain the fact that plants of the *leguminosæ* family, wither in the water in which the same species have grown until the excretions have colored it brown, whilst corn plants grow vigorously in the liquid, and the brown color diminishes sensibly with the growth of the plant.

You will observe in this experiment, that the plants selected are unlike in their organism, and whilst the one feeds largely on the phosphates, the other requires scarcely any. I ask Mr. Turner if the inference is not irresistible, that the beans first grown in the water, had destroyed its fitness to sustain a second crop of them, either by exhausting the peculiar food on which they fed, or by *poisoning* the water with their excretions? It is not equally clear, that at the same time that the liquid was thus rendered unfit for the support of beans, it still retained a capacity for producing corn, and that this corn, instead of rejecting, actually fed upon the exudations of the beans? If true, as is proven, with regard to the *water*, I would again respectfully ask your intelligent correspondent, would it not be equally true of the *soil?* Can there be any difference, when every thing absorbed by a plant from the soil must necessarily be previously dissolved? I am sure he will at once admit that the second fact is a legitimate corollary from the first, and in so doing his own theory loses its foothold, and falls to the ground. If this experiment were not so perfectly conclusive, it would be very easy to pile proof upon proof, "Pelion upon Ossa," in support of it.

Liebig relates an instance of a landed proprietor in the vicinity of Göttingen, who, to obtain potash, planted his whole farm with wormwood. The consequence of which was, that it so effectually exhausted the potash in the soil, that it was incapable of bearing grass for many years—the grass requiring a large supply of the silicate of potash.

In combating these universally received opinions, Mr. Turner sets out, rather ominously, in the midst of a strange confusion of technical terms, and an entire misapprehension or misapplication of authors quoted, and when he has thus, under the delusion of an honest zeal for his theory, dove-tailed an ingenious and plausible argument, he then endeavors to varnish over the whole with some striking facts.

In adverting to this part of Mr. Turner's essay, I will not confine myself to his precise language where it is unimportant, as it would unnecessarily lengthen what I have to say, but merely quote the substance.

He says there is one ingredient which is necessary to all crops, and that ingredient is *fertility;* and that this ingredient is just as necessary to one crop as another. *Fertility*, as understood by him, is synonymous with humus, as understood by Prof. Webster, geine as called by Prof. Dana, and ammonia as maintained by Liebig. He makes, in confirmation, an extract from the second report on the agriculture of Massachusetts, whereof Prof. Dana says, "If we can induce the state of geine best fitted for each plant, then adieu to the doctrine of the necessity of a rotation of crops." Without quoting farther at present, let us halt and review the ground.

That this *fertility* here referred to, and easily comprehended by every farmer, is not, as Mr. Turner supposes, synonymous with humus, geine, &c., will be perfectly obvious when it is recollected that many plants, wheat for instance, will not

thrive in pure humus. The word fertility, as used by Mr. Turner, is much more comprehensive. Liebig states that, in many parts of Brazil, where the soil is particularly rich in humus, wheat will not thrive, and in many parts of Europe, where they have formed soils of mouldered wood, [pure humus,] it has been attended with the same result. The stalks attain no strength, and droop prematurely. The cause assigned is, that the strength of the stalk is due to silicate of potash, and that the grain requires phosphate of magnesia, neither of which substances a soil of humus can afford. Liebig adds that wheat will not flourish on a sandy soil or a pure calcareous soil, (*e. g.*, the bald, calcareous prairies of Alabama,) unless it be mixed with a considerable quantity of clay. These soils are deficient in the alkalies, which are indispensable constituents of wheat, while potash and soda are universally present in clay.

But Professor Dana says, "if we can induce the state of geine best fitted for each plant, then we may bid adieu to the doctrine of the necessity of a rotation of crops. This may be true, but the very condition on which it is made to depend destroys its applicability, as used by Mr. Turner. "*If we can induce the state of geine*," &c., is the language of the author. But how induce it? Geine or humus, or to be more specific, the decomposed organic matter of the soil can only be brought to the state necessary to give vigor to the growth of plants indiscriminately by the presence of alkalies. Humus is not soluble in any useful degree in water, requiring as it does two thousand five hundred parts of water for one of humus, while it is readily soluble in alkalies. If then you can always have the requisite supply of alkalies present, you at once induce that state of geine so much desired by Prof. Dana. But can any practical mode be devised of effecting this, other than a judicious rotation of crops, which will feed successively on the different constituents of the soil, and give to the great laboratory of nature time to restore what has been taken away?

But Mr. Turner, feeling probably the weakness of his argument, and the inconclusiveness of his authority, endeavors to sustain himself by a few isolated facts. It seems to me, however, that little weight should be given to these few straggling examples, ("*rari nantes in gurgite vasto*,") which his industry has picked up over our extended country, against the proofs of philosophical investigation, and the almost unanimous testimony of enlightened farmers in every quarter of the world. It is an old adage "that a single swallow does not make a summer," and my Lord Coke says, that exceptions to a general rule, instead of weakening, prove it. The most striking example relied upon by Mr. Turner is that recorded by Mr. Colman, the Massachusetts commissioner, who says, that he saw a rich alluvion field on the Connecticut river, the proprietor of which told him that without any manure it had continued to produce good crops of wheat for thirty years in succession. This you will observe is a piece of intervale land on the borders of a stream whose low grounds are of remarkable fertility, and whose inundations annually, or at intervals of several years, may have deposited new soil, and thus maintained its capacity to produce the same crop. The Nile, the Po of Italy, and many of the principal rivers of France, have long been employed as fertilizers of their low lands, and wherever they have been able to irrigate them, they exhibit the same capacity for production with the example cited by Mr. Colman. The most important alkalies always abound in such lands. The overflowing waters, too, hold oxygen in solution, and are thus enabled to act promptly and effectually in producing the putrefaction of the excrementitious matters contained in the soil. But, Mr. Editor, I did not take up my pen with the view of discussing this question with so skilful an antagonist as Mr. Turner, but merely to draw your attention to the subject, that you may enter the lists, and allow me to retire. This letter has insensibly grown to so inordinate a length, and so contrary to my intentions, that I feel that I almost owe you an apology for troubling you with it. When I had once embarked I found all my efforts to regain the shore fruitless, until the present moment.

Yours respectfully,

WM. M. PEYTON.

P. S. Allow me to add by way of postscript. In the same number of your Register, containing the article commented on, I observe, in a very sensible essay addressed to the Board of Agriculture, by Mr. Noel of Essex, an allusion to a universally conceded fact, which is in confirmation of what I have written, and of course in conflict with the theory of Mr. Turner, viz.: that a new peach orchard will not flourish on the site of an old one. He says, in his absence the holes which he had dug for an orchard were filled with the rich dirt taken from the sites of the decayed trees of an old one; and he seems to have viewed it as so palpable a blunder, that he goes out of his way to exculpate himself from any agency in it. I will here add, that I hope Mr. Turner will appreciate the frank spirit in which these strictures are made, when I add that I have read his agricultural essays with pleasure and profit, and that I hope he will continue to shed his light among his brethren.

W. M. P.

Editorial remarks.

We had supposed that, to so long continued and attentive a reader of the Farmers' Register as Mr. Peyton has been, it could not have been a matter of doubt whether our silence, or omitting to deny or object to the opinions of correspondents, implied assent and confirmation. We have had frequently to reply to the like question; and have always answered that our correspondents were free to present their opinions, however different from our own; and that we neither deemed it incumbent on us, or requisite, or even proper and justifiable, to offer editorial comments and objections to every opinion or statement in which we did not concur. If such had been our duty and usage, perhaps such comments and protests would have amounted in bulk to half the size of the articles commented on; and, after all, our opinions would have been worth no more than those which very many or all other observant agriculturists could as well form without our suggestions. It

was only when particular circumstances made it seem necessary and proper, that such editorial comments and objections were made—and then to no greater extent that was deemed requisite. But, independent of offering opinions thus particularly applied, there certainly has been no lack in the Farmers' Register of the expression of our own views, on every disputed and important question on which we supposed it in our power to throw light. And among such questions, there is scarcely one on which our opinions have been more frequently and decidedly given, than in favor of the propriety and necessity of changes and rotations of crops on proper principles. Therefore, as well as on the more general grounds above stated, it was not deemed necessary to reply editorially, to what we certainly deemed the "heterodox" doctrines of Mr. Turner, in opposito the necessity of changes in the succession of crops. Moreover, we had no doubt that some other would come forward, to oppose the views of Mr. Turner on this head, as Mr. Peyton has done, whose experience and ability would leave nothing to regret, because of our silence.

There was another reason for our being silent in this particular case. Mr. Turner came into the lists like a knight challenger of ancient times, slowly and sluggishly indeed as *Le Noir Faineant*, but also like him armed cap-a-pie, and seeming even to court the blows of opponents. His defiance was universal, and his ready lance seemed to threaten every quarter. Believing that he could not fail to arouse plenty of opponents on various grounds of contest, we were therefore the more willing to keep out of the *melée;* and more especially as being already engaged to oppose him upon one particular ground of controversy which could not be avoided, and in which we had endeavored to maintain our ground just before receiving Mr. Peyton's implied rebuke for our backwardness in the present question.

However, having been now thus called on to speak, we will add a few views on a different ground from that which Mr. Peyton has taken. He has occupied, and maintained well, (though we could not sustain him in every position,) the theoretical and scientific argument for rotations of crops. We will merely advert to a few detached facts, and matters of practice, without regard to theory, or to scientific reasoning.

Mr. Turner has quoted, as proof to sustain his opinions, the facts reported to him by several persons, that they had cultivated some one or other particular crop for several or many years in continued succession on the same ground, without deterioration of product, or only such deterioration as was caused by the decrease of fertility, caused by such exhausting tillage. The fact that any person had persevered in so injudicious a course for any length of time, and without learning his error from experience, would show him to be so injudicious a farmer as would alone bring his testimony into doubt. We are very sure that Mr. Turner will never have such proofs to offer from his own practice. But admit all the facts alleged by his informants of their success, and what do they amount to? Why, merely that, as in thousands of other cases, particular facts have contradicted, or have appeared to form exceptions to general rules. And if such apparent exceptions are to be admitted as serving to discredit general rules, then there is no one rule of good farming that cannot be so opposed, and its utility or necessity put down by the authority of facts. We have heard of cases as well established by testimony as those stated by Mr. Turner, which, if deemed conclusive, would as clearly prove that manuring land did no good to the crop—that purchasing and applying rich town manures brought the neighboring farmer to loss—that marling was injurious to land, &c. In short, there is scarcely any one agricultural opinion, however false and even ridiculous, that has not been sustained by one or more *facts* alleged by honest and veracious though certainly mistaken witnesses. And these particular exceptions referred to by Mr. Turner, however apparently successful and profitable, have never been considerable enough, or long enough continued, to cause any general practice to be founded on their example. No farmer, good or bad, has adopted, as a system of cultivation, the continuing the same crop on the same ground every year. There are many different rotations of crops pursued in Virginia, some few of which are good, or established on sound principles, and very many are decidedly bad and very objectionable. But, whether the rotation be right or wrong, every cultivator aims at some rotation, or change of crops, instead of continuing one alone in perpetual succession on the same ground. But universally as is rotation thus approved by practical cultivators, perhaps such testimony may be objected to, (as might many other general practices,) become of the ignorance of most practical cultivators, and the theoretical and visionary views of the more learned. Therefore, we are content to put aside all such authority, and to abide by the practice and experience of only one intelligent, observant, practical and successful farmer; and the credibility of that witness shall

be beyond all doubt or cavil—for we shall summon as that witness Mr. Turner himself.

If no change of crops be necessary, why does Mr. Turner follow corn by oats, and oats by grass? If there be no necessity for, or superior profit in this succession, why not as well reverse the order of these crops, or keep corn always on one field, oats on another, and grass on the remainder of the farm? If the answer be, that although corn might well follow corn, and oats follow oats, yet that the corn tillage cleans and prepares the ground for the growth of oats, and that the oats shelter the young herds-grass and clover, this explanation is, in fact, yielding the whole question, and stating good and sufficient reasons for the particular succession stated.

Mr. Turner's rotation is uncommon, and even peculiar. Still it is not therefore less a rotation; and, according to his peculiar position, we had given him credit for having adopted a rotation of very valuable features and effects. We especially admired the plan of two successive crops of corn, (though a different kind of hoed crop might have been better in place of one of them,) though such a repetition might have been a barbarous and abominable part of a course of crops at ten miles from a town, or where no putrescent manure could be obtained other than the farm furnished. With Mr. Turner, grass for hay is the most important and profitable market crop. Oats is the next in importance, and corn is not worth raising for sale, and only desirable for bread, and as a cleansing crop to prepare the fields successively for grass. To make the most of this cleansing operation, and because he can make up by purchased manure for the double exaction from the field, he cultivates two crops of corn in succession, and thereby makes the ground as clean as possible. Still herds-grass and clover would not take well immediately after corn; the shade of oats is required as shelter from the sun, and even the exhausting power of oats, to keep down weeds, and when reaped, to leave the land wholly to the young grass, when nursed to an age to be able to withstand both sun and weeds. The land then remains several years in grass, until weeds have gained the ascendency; when the crop and tillage of corn again are resorted to, for the purpose of recommencing the same rotation. We merely here present reasons, and aim to show that Mr. Turner not only uses a rotation, but one founded on sound principles, according to our views of the theory of rotation. The practice—the facts—the merit of the system—are all his own; and we have so much respect for his excellent practice, in this respect, that we are content to rely on it alone to rebut all his arguments against the necessity of rotations, even were his witnesses, and particular facts of exceptions to general rules, ten times as many and as cogent as they are.

Mr. Turner has been singularly unlucky in one case adduced as practical proof of there being no necessity for a change of crops. In this case Nature is the cultivator, and her farm "is the world, and the crops are the immense forests with which it is covered"—and Mr. Turner adds, "here too is no relief from rotation, for the same crop has been on the land for thousands of years." (p. 322.) Now the actual facts are directly the reverse—and so striking, that they have been often cited by writers as proofs of the necessity of changes of growth. The ordinary growth of a forest, even at the same time, is far from being the same crop. There are many different trees, as different in kind, and in their habits and wants, and products of manure by their decay, as the different kinds of cultivated grains and grasses. Therefore, even though the composition of a forest might appear to be unchanged in general, for thousands of years, yet it probably is the case that entire changes are perpetually made in the death and replacing of each tree. For example, a pine may occupy its place for a century, and then die, and be succeeded, not by another pine, but by an oak, which may stand for five centuries, and then be succeeded by a beech or poplar. But Nature is not satisfied with this gradual change and rotation by mixing crops. When fires, the depredations of insects, inundations, or tillage, have completely destroyed a forest growth, another succeeding growth is generally of trees entirely different. Thus, if a forest principally of oak, short-leaved pine, hickory, dogwood and chinquapin, in lower Virginia be cut down, and the land suffered to grow up again, (either early or late,) the next growth of trees will be almost exclusively of pine, and that of a different kind (the "old field pine,") from those which formed part of the previous cover. This is a fact notorious to every resident of this region. In other regions the changes of kind are different, but not less marked than these. And so complete have been such changes, and such totally new growths of trees produced, that many persons, and even some men of science, have thence believed in the spontaneous production of such new growth, or equivocal generation of the new trees, because they could not conceive whence their seeds had been derived. Such facts and proofs, directly opposed to Mr. Turner's position, are too numerous to be cited here. The subject is however curious and

interesting, and may be resumed hereafter in a distinct and substantive article.

In sundry of the particular positions assumed by Mr. Turner as proofs, or steps in his argument, we entirely concur, and suppose that no one would dispute. For example—it is not our opinion, nor the opinion of any reasonable advocate for rotation, that the mere growth of any crop serves to enrich the land producing it—or that any rotation of crops, if all are removed, can increase fertility. Nor would we dispute that some *tilled* crops, as corn, cotton and potatoes, (the very cases adduced by Mr. Turner,) may each be continued for many years on the same ground without very manifest deterioration, especially if dressed by various kinds of manures. But the true question is, could not, even in the most successful cases, these crops have been raised better, and to greater profit, if alternated with others? But even the admission of such exceptions cannot be made as to *broad-cast* crops, which are not cleaned by tillage. It is manifest and notorious, that neither wheat nor oats, nor any one kind of grass, can be continued to any profit, for years in succession on the same ground. Mr. Turner's statement of his own herds-grass giving place after a few years to green-sward, or to weeds, is not only a proof of this position, but also of Nature's urgent demand for a change of crops.—Ed. Far. Reg.

LIME.—THE WHEAT CROP, &c.

To the Editor of the Farmers' Register.

I lament, my dear sir, that you should think of giving up your useful labors; believe me when I assure you that the Farmers' Register has been a great public benefaction, and I must hope that you will not discontinue it. If you would be contented to take the vote of Virginia as your guide, I am sure you would have an overwhelming vote to go on. Men may differ, and do differ on every subject; from the hour that "darkness dwelt upon the face of the deep," man has dared to differ with his God, how then could you hope for agreement and sympathy? You have been his benefactor; what of that? Is he not in a free country, to take such things as he does, and his neighbor's grounds, and use them according to that barbarian thing called the "enclosing law," or "act of assembly." If a people be legislated into barbarity, why complain of them if they have not the fear of God upon their minds?

I owe much to your correspondents for amusement and instruction, and I would not on any account offend the least of them: let me, in this feeling, give you a few facts.

I have used, in the last twelve years, seventy thousand bushels of lime, with full and complete success. If I say the crops have been doubled, I am within the bounds of truth, save in two previous crops of wheat, which were failures. The present is very great, and I impute it to the difference in cultivation; the failures were after three and four ploughings, the present after one only. This however is the ninth day since I began my harvest, and I have not, from rain, cut twenty acres. A few days more of such weather must sprout it all in the field.

My corn is fine, and that for twelve years or more has been planted upon one ploughing; it is then coultered twice, and the cultivator finishes. But let me add that 8 cultivators pass over my field in four days, and I am persuaded that I get more from the atmosphere than the corn uses in its growth. For this reason I call it my chameleon crop, and feed it freely.

My oat crop upon limed land is not slow to show the power of lime. My clover, sir, is the food, the meat and drink of all other crops. I save my own seed, and sow in the pug, twenty bushels to the acre, as clean as the hand rake will make it from the thrashing machine, and that is as little as we give. This gives dear old Mother Earth a perfect robe of green; and when the blossoms set, it takes no poet's imagination to see that the dear old lady is in a dignified strut. I never fail to give one or one and a half bushels of plaster in March; and say what you may or please about philosophy, plaster upon limed land is worth six times its weight in fine flour upon your table. I forgot to say that I put a spoonful of plaster to each hill of corn as soon as it is planted, and that I plaster my meadows every spring with full and entire satisfaction as to results. Lime—lime—lime.

Fairfax county, June 18th, 1842.

THE WHEAT HARVEST

Has just been finished, or is about closing, on every farm in this region, and the result is certainly very far below the recent anticipations of an uncommonly abundant crop. Rust struck the crops, almost universally throughout eastern Virginia, but a few days before the wheat was fit for the scythe, which alone would have lessened the product very considerably. But added to the always disastrous effects of this worst disease of wheat, rains fell almost every day throughout harvest, and sometimes in immense quantity, so as to damage all other crops also, and especially the cultivated lands, by flooding and soaking the level, and washing the hilly surfaces. From Monday, the 13th, when the harvests here commenced, there were 10 or 11 rainy days, and only one day in which rain did not fall (Sunday, 19th); and during that time, nearly all the crops were reaped, and greatly exposed, and more or less damaged, or wasted by the necessarily hurried and bad work under such circumstances. Many of the shocks are yet wet, and require to be taken down for drying. No farmer can yet estimate his own loss, with any approach to accuracy, and of course a general estimate must be very uncertain. But the general loss cannot be less than one-fourth of the whole crop of eastern Virginia, as it promised a few days before ripening. We have passed through and seen crops of seven counties during harvest. No certain information from the mountain region has yet been received. The last rains were on the 25th, and since the weather has been fine. On the level lands of Gloucester, and still more of Mathews, great loss was counted on even in the oat crops, from excess of wet; and also to the corn crops, because of their foul state, and the long time before the ground could be again ploughed.—Ed. F. R.

June 29, 1842.

From the Dumfries Herald.

A NEW SOURCE OF THE BEST MANURE.

"Ne saturare fimo pingui pudeat sola; neve
Effetos cinerem immudnum jactare per agros."
VIRGIL.

In cold and temperate climates, the value of farm-yard manure has been known from the earliest period. It contains, or it leads to the formation of, every ingredient which our field crops demand from the soil, and it gives off its riches gradually as they are needed.

But it has always been a difficult matter to obtain this in quantity sufficient for the wants of a hard-cropped soil. The demands of our increasing population proclaim its inadequacy. The labor of cartage draws deeply on the farmer's funds; and the want of more portable manures is now extensively felt.

Bones, charcoal, burnt clay, and various salts, have, in turn, presented their claims. But of all the substitutes for farm manure yet proposed, none has claims so extensive and well founded as those of *wood ashes*. These already contain nearly all that plants draw from the soil. On warm soils, they so powerfully dispose the formation of ammonia and nitrates, that they render the addition of dung almost needless. They promote the disintegration of the soil, accelerate vegetation, and require little cartage.

The chief difficulty, as yet, has been the scarceness of the article: and my object at present is to point out the source of an abundant and cheap supply, for the wants of at least the present generation—*a supply which may be the means of adding to the wealth of Britain, doubling her produce, enriching her colonies, relieving her surplus population, extending her dominions, meliorating climate, and doing hurt to none.*

Our countrymen who emigrate to Upper Canada, find vast forests which they would more actively remove, if they had a remunerating price for their labor. By them, much of our pearl ash is supplied. They burn the wood, collect and lixiviate the ashes, evaporate the ley, and sell the "*black salts*" to purifiers, who present them to us in the form of pot or pearl ashes. Their methods at present are said to be clumsy, and their matters imperfectly collected; yet some of the more enterprising clear 20 acres annually, and pay all their expenses from the sale of their black salts. But, as many leave the ashes unheeded, where the wood is burnt, it seems that the supply is easily made to equal the present demand.

Now, sir, if a greatly increased demand were made, not perhaps for black salts, but for well burnt ashes, the labor and expense of lixiviation and purification would be spared, and an article better suited to the wants of the farmer would be obtained at a very moderate price.

It may safely be assumed that a ton of ashes is wasted for every hundred weight of good pearl ash which reaches this country. The increased carriage and freight would certainly be more than compensated by the want of trouble in purification, and hence we might have the ashes for 2s. to 2s. 6d. per cwt.

Eight hundred weight of these, per imperial acre, mixed in a little farm manure, would be quite enough for a five years' rotation. I have no doubt but that *six* hundred weight of these ashes, judiciously mixed, under cover, in six carts of good dung, will, in raising a turnip crop, be found equal to 30 bushels of bones, and will leave the ground as fertile. As every farmer can easily, on his own farm have more dung than he thus needs, his whole cash outlay for manure will be only 12s. to 15s. per imperial acre, instead of 90s. when he uses bones; and the difference of labor will be very trifling. On the second grass crop, the addition of other two-hundred weight of the ashes would *amply* pay the expense.

Let men of capital and scientific acquirements remove to Canada, and employ poor people in cutting and burning the wood, and clearing the ground. This will employ many who cannot now find work. The ground cleared, will require people to cultivate it. Roads will be improved. Our Canadian colony will rapidly grow in value and importance. An increased market for our exports will be opened; and the same trade may be extended to our other colonies, where wood abounds to a hurtful extent.

The guano trade must end in disappointment.

The bone trade sends the money of the British farmer to enrich the nations of Northern Europe; but the Canadian ash trade, will enable the Britons to put money out of one of their pockets into the other.

Nothing truly valuable is effected without some difficulty; and I merely throw out the suggestion, that better-informed minds may digest a working plan. The bulk of the ashes may be objected to, and some method of concentrating them may be devised. But while I know that trees contain too little silica for corn plants, I believe that the value of the ashes would be diminished at least one half, by the removal of silica.

We have lately heard of our government encouraging colonization. I hope their attention will early be directed to this matter; and I am, your obedient servant, P. G.

NEW ARTIFICIAL MANURE.

From the New Genesee Farmer.

We have seen, in several English publications, notices of a new manure invented by Mr. Daniell. The following account of it, given to the Royal Agricultural Society, we extract from the Boston Courier, a paper always alive to the subject of agricultural improvement, which quotes it from a London paper. We subjoin a letter on the same subject from our intelligent correspondent at Boston; and shall give, at the earliest opportunity, any farther information which we may obtain.

"It had long been a subject of inquiry, what is the food of plants, how are they supplied and what are the elements of their growth? There was every reason to believe that a reply could be now given of a more satisfactory nature than had ever been hitherto known; besides which, by the discovery of Mr. Daniell, a most important corroboration had been obtained of what had been considered the elements of vegetable growth; those elements were carbon or charcoal, hydrogen or inflammable gas, oxygen or vital air, and nitrogen. All these elements existed in the atmosphere, in combination with other elements, in which state they were found to be the sources of

vegetable developement. It was known to persons accustomed to rural pursuits that the heaps of vegetable substances collected for the purposes of manure, during the process of decomposition, became greatly reduced in bulk and weight. If they investigated the causes of this reduction they would find that it was occasioned by the evaporation of the carbonic acid and ammonia, the principal sources of nutriment to plants. The discovery of Mr. Daniell contained all the elements of vegetable growth. It did not supply new elements, but the same derived from other sources. It was known that by combustion substances were rapidly decomposed, and its operation produced the elements of vegetable growth. There were on the earth numerous plants which were apparently useless, but it was a principle in nature that nothing should be lost, and they were capable of a reduction into their elements, and being made the means of vegetable growth in other forms. The discovery of Mr. Daniell was suggested by the fact that, while burning vegetables, he observed that the ashes became blackened by the surrounding smoke, and when used in that state were very fertilizing. This led him to investigate the cause, and as the result of his investigation he had produced the new manure, the elements of which were carbon and ammonia. With it the principal properties would not fly off during decomposition, as that would take place in the earth. Among other advantages, it was light in weight, cheap, and capable of being produced in any quantity.

"This manure has been applied by the discoverer to his own crops, on three acres of poor land, in an elevated situation, on some of which he has grown wheat four successive years with improving results each year; its good effects are therefore founded upon experience, personal observation, and the testimony of other observers competent to judge. From the nature of the manure, it is applicable, with some variations in its composition, to every kind of crop. It is not a stimulating manure, in the ordinary sense of the word—that is, it will not have a tendency to call into activity the existing resources in the soil—but its direct effect is to convey to the soil the direct nutriment of future growth. This effect is produced by the supply of ammonia to the soil in substances calculated to retain it for a time—to again absorb it from the atmosphere—as they give it out to plants during their growth. It will probably prevent also the ravages of insects. Its mode of application may be various, according to the circumstances of the crops. The application by drill is conducive to economy of the manure, and a direct application to the infant plant as is the case with bone dust. Care, however, must be taken that it is not applied too directly to the plant, or without some portion of mould around it. This is the only precaution needed to avoid danger in its use. There is one required to prevent waste, as it is of a volatile character; that is, to place it several inches in the earth, as the earth will absorb and retain the volatile and valuable part. For grass lands, for similar reasons, it will be well to have it mixed with a considerable portion of ordinary unvalued mould. If the manure, as manufactured, be mixed with an equal bulk of mould, it will be perfectly safe for application; or if the mould of the field be stirred over it when drilled it will suffice. The quantity to be used will vary according to the crop, like any other manure. About twenty-four bushels per acre are recommended for wheat, and half as much more, or thirty-six bushels, might be beneficially applied for turnips or mangel wurtzel. The most beneficial quantities will easily be ascertained by the intelligent farmer."

Mr. Hall produced a sample of the manure—a coarse black powder, having a strong smell somewhat resembling coal-tar. Samples of the wheat grown by Mr. Daniell were also exhibited, and it was stated, in reply to questions, that the crops produced were greater in quantity, better in quality and weight, and produced with one-third the ordinary quantity of seed. The manure will probably be about one-third the present price of bone dust.

NEW ARTIFICIAL MANURE.

From the same.

The knowledge of the ingredients of the celebrated artificial manure of Mr. Daniell, has at length reached this side of the Atlantic. They are as follows:

Any wood mechanically reduced to powder—in plain words saw-dust—this is the basis, and it is to be thoroughly saturated with bituminous matters of all or any kind—to this is to be added small proportions of soda and quick lime, and a very small quantity of sulphur.

The principles on which this compound is formed appear at first rather obscure, but one thing is apparent, it is an attempt to make an artificial bituminous coal and to keep this in a state of slow combustion with only the substitution of soda for the potash of the wood and the addition of quick lime. We are not told the proportions, nor how long the compost is to remain before used, nor what the bituminous matters are; the only additional information is that it should be buried two or three inches under the surface of the soil.

Before I proceed farther with an analysis by reasoning of this new artificial manure, I must lay before you well authenticated proofs of the value in agriculture of the products of the combustion of bituminous coal.*

Bituminous coal contains from 13 to 16 per cent. of nitrogen or azote, and 4 to 12 per cent. of hydrogen—when the coal is burnt, these two gases unite and form ammonia—when burnt in the open air the ammonia goes partly into the atmosphere and is partly condensed in the soot. When it is burnt in retorts for the purpose of affording gas for illumination, the ammonia is dissolved in the liquor used for purifying the gas, and is called the ammoniacal liquor of gas works. According to Mr. Blake of the Boston gas works, 1 chaldron, or 2700 pounds, gives 33 gallons of this liquor, containing 5 per cent of ammonia, and 24 gallons containing 4 per cent—but the strength of this

* Turner's Chemistry gives the following proportions of nitrogen in 100 parts of coal:

	Caking coal.	splint coal.	cherry coal.	canel coal.
Nitrogen	15.96	6.25	10.22	13.72

There is much reason to suppose that these amounts are considerably overrated.

liquor generally varies in different and also in the same gas works.

In the Gardener's Chronicle, 2d of April, 1842, is a detail of the following experiment made with this liquor :

A large quantity of this ammoniacal liquor was tested for its strength—it was found that it took 5½ pounds sulphuric acid, containing 65 per cent. dry acid, to neutralize 87½ lbs. liquor. It was then divided into four parts—in the first the ammonia was neutralized by phosphoric acid, forming phosphate of ammonia—the second with sulphuric acid, forming sulphate of ammonia—the third with nitric acid, forming nitrate of ammonia—the fourth with muriatic (hydro-chloric acid) forming muriate of ammonia.

Each of these solutions were so mixed with these acids, that the quantity of ammonia in each was the same ; they were much diluted, and half a pint of this dilute solution was given to each plant every other day. Thirteen experiments were made with 25 cabbage plants each. The weight of the cabbages, taken up in the autumn, was as follows :

No. 1. Liquor neutralized by phosphoric acid, to which was added 300 grains of a mixture of sulphate and phosphate of lime. 103 lbs.
No. 2. do. by sulphuric acid and the same mixture, 99 lbs.
No. 3. do. muriatic acid do 73 lbs.
No. 4. do. nitric acid do 65 lbs.
No. 5. do. with carbonate of ammonia dissolved, leaving the same amount of ammonia with the earthy salts, 58 lbs.
No. 6. do. with phosphoric acid but no sulphate or phosphate of lime, 62 lbs.
No. 7. do. sulphuric acid do 39 lbs.
No. 8. do. muriatic acid do 29 lbs.
No. 9. do. nitric acid do 23 lbs.
No. 10. do. carbonate of am. do 12 lbs.
No. 11. do. with dung alone, 37 lbs.
No. 12. do. without dung, 23 lbs.
No. 13. do. Poitevin's dried manure, 40 lbs.

Here No. 5 and No. 10 are useless or perhaps worse,—carbonate of ammonia already existing in the liquor, and the addition of more only rendered the solution perhaps too strong, to the injury of the plants, as the result shows.

In No. 56 of the Scotch Quarterly Journal of Agriculture, is an account of 4 acres grass land put under experimental cultivation,

1 acre with 112 pounds saltpetre,
1 " 168 " nitrate of soda,
1 " 560 " rape dust,
1 " 105 " gal. ammoniacal liquor.

The strength not mentioned, but diluted with five times the quantity of water.

The acre with the nitrate of soda exhibited the earliest luxuriance of vegetation.

That with ammoniacal liquor the next, but this soon surpassed all the rest.

That with rape seed showed the effect the latest, but improved greatly as the season advanced.

The produce from 31 square yards of each was, in weight of grass—

With saltpetre, } nearly the same, averaging 98½ to 100 pounds.
" nitrate of soda, }
" rape dust, }
" ammoniacal liquor, 126 pounds.

When made into hay under equal circumstances, on the 2d of August, the result was—

with saltpetre, 31 pounds,
" nitrate of soda, 32 pounds,
" rape dust, 30 pounds.
" ammoniacal liquor, 46 pounds.

In experiments with other substances as manure, the product with ammoniacal liquor always exceeded considerably the rest.

These appear decisive experiments, as to the great value of the ammoniacal liquor produced by the combustion of bituminous coal. If, therefore, this new manure will give us an artificial bituminous coal, which will of itself enter into slow combustion and furnish vegetables with this ammoniacal product by degrees as wanted, it must be of immense value to agriculture ; and in truth this operation will have to be judged of by observation of its continued effects as much as by those of its immediate action. The value of bituminous soot as a manure has never been doubted ; but like many other manures, it has too often been applied in such large quantities or in such strong solutions, as have rendered it injurious instead of beneficial. The farther consideration of this new manure I will, however, leave until my next letter.

J. E. T.

THE INFLUENCE OF THE ORIGIN OF SEEDS ON THE QUANTITY AND QUALITY OF CROPS.

*By Dr. Bronn, Professor of Rural and Sylvan Economy in the University of Liege.**

[Translated for the Farmers' Register, from the *Journal d'Agriculture, etc., des Pays Bas.*]

Even to the present day, the cultivators of forest trees have not thought of taking advantage of a phenomenon which is presented to us in the cultivation of agricultural plants, and which, although it has never yet been sufficiently explained, is nevertheless well established. This phenomenon is the influence which seed exerts on the quantity and quality of the crop which is produced from it, according to the different nature of the soil and climate from which the seed has been procured. The good results of this influence have appeared after using seed from a cold climate and a tenacious and cold soil, in a warm climate and a dry and light soil ; but they are also equally apparent under circumstances quite the reverse, provided the soil be not too dry and barren, and the seed has had the opportunity of being developed and coming to perfect maturity. It appears then that the two opposite kinds of soils and climates profit equally from a change of seed. Let us consider and examine at first a few observations which may serve to explain this phenomenon, and thence endeavor to deduce the physiological law, and apply it to the cultivation of trees.

The advantages resulting from a change of seed are generally recognized in the cultivation of the

* Professor Bronn's article is here republished, in obedience to the request of one of our most valued correspondents, made in the early part of this volume. It now receives additional value from the remarks appended.—Ed. F. R.

cereal plants. In some mountainous countries, in Scotland for example, they bring the seed from the low country and from the plains, where the climate is more mild, and consequently the seed more forward, a quality which it always preserves for several generations. We are convinced that the cultivator of this mountainous district, if he always used seed from his own crops, would reap later and later harvests, so that at last perhaps they would not come to perfect maturity; a circumstance easily explained by the short duration of summers in the mountains. If, on the other hand, the cultivator of a flat country, the climate of which is mild and the soil dry and light, continually made use of his own seed, it would head every year sooner, the stalks would become shorter, and the heads and grains smaller and smaller, and in time there would result but a poor produce. In this last case the cultivator brings his seed with advantage from a country more cold, the soil of which is good and substantial. Probably these are the circumstances on which rests entirely the difference between the cereal plants of summer, and those of winter, a difference too variable to be easily determined.

The flax, without doubt, presents us with the most striking example of this phenomenon. We, with great advantage to our crops, bring our seed from Riga, *i. e.*, from a colder climate—the sowing of which causes the grain to be slowly formed, and thus leaves more time for developement of the stalk, which is the principal object of its cultivation. To judge by analogy, we would be led to believe that the result would be the same, were we to obtain from a colder country and a colder soil the grain of the clover and other plants used for forage, in the cultivation of which our object is large stalks and a well developed foliage. Even at the present day we are without experience on this head.

Generally, all plants which are principally cultivated for their grain or fruit, need little or no manure; while manure is necessary for those plants from which we wish to obtain large stalks and leaves.*

Fruit trees which shoot vigorously, generally bear little or no fruit; and every circumstance, which on the other hand prevents the too great growth of wood, favors the formation of fruit. On this observation rests the cultivation of dwarf fruit trees, and espaliers; also that of the vine, &c.

Field plants and plants of the kitchen garden (under equal circumstances in other respects) blossom sooner in dry, warm and clear summers, and their stalks as well as leaves are smaller, than in rainy and cloudy summers.

From these and many other analogous observations, we can deduce a physiological law of the greatest importance in the cultivation of plants, to wit: Every thing which favors the disproportioned growth of vegetables, opposes or retards their propagation or formation of fruit; and *vice versa*, the formation of fruit is hastened and forwarded at all times when exterior circumstances prevent the full developement and disproportioned growth of the stalk.

Now to apply this law to the rearing of trees, I ought first to remark that many of the phenomena which I have mentioned, are equally apparent in the vegetation of forest trees, although they have not been so much noticed. In fact we see the greater part of our forest trees bear seeds sooner, more often, and in greater quantities, with a south exposure, and in a dry and light soil, than with a north exposure, and on a cold and stiff soil; while under the latter circumstances they acquire greater dimensions.

Many trees, the birch for example, vary with regard to the time of budding and formation of seed, some being forward, and others late. It is well ascertained that those which bud late, have the hardest, heaviest, and in every respect the best timber, and increase more in volume within a certain time, than the more forward kind. It is not yet proved that the same phenomena may take place relative to age, *i. e.*, that there may be varieties which blossom and bear seeds, and the growth of which consequently diminishes at different ages. This appears very probable, since we frequently see larches, firs, birches, &c., trees which had their origin in a cold and elevated country, bear seeds in a low, dry and warm country, after having scarcely reached the age of ten or fifteen years, and ten or fifteen feet in height; and the growth of which afterwards becomes sensibly slower.

From this observation we may conclude that the trees of cold climates produced from seeds gathered in dry and level countries will degenerate after many years to dwarf trees, shrubs, bushes, &c. which will scarcely ever be of any value as forest trees. Every attentive cultivator of forest trees will have already noticed similar examples, which will justify this conclusion.

From all that precedes, I deduce for the rearing of timber trees this general law: It is necessary to procure, as far as possible, the seeds from a colder climate, and a colder and stiffer soil, than the climate and soil of the country on which you wish to rear these trees.

One of the best things for cultivation in the sandy lands of the provinces of Limburg, of Anvers, and of Northern Brabant, is undoubtedly the sylvan pine, [*pin sylvestre.*] According to the rule just above, the seed gathered in this dry and barren country should not be used, but ought rather be brought from a colder country, or from some place, the soil of which is colder and stiffer. Since some time back, in France and elsewhere, the preference is generally given to the seeds of the pine from Riga, Norway, Scotland, Haguenan, &c., and the rule which it is my wish to establish, has thus been followed by us, but without our having been able to justify this preference by reasonable motives. We have been content to regard the pines of this country as a particular species or variety.

The fir *epicea* (a northern fir,) and larch, are suitable to be reared in the mountainous lands of Ardennes. If we used the seed which grows

* The author's meaning must be taken with reference to the usual rotations of his country, according to which, crops raised for their seeds, are preceded or followed by grass crops, or others, in which the bulk of the whole plant is of far more importance than the quantity or the perfection of the seeds—and according to his theory, crops of the latter kind would receive so much more benefit from the manure than the former, that economy requires the farmer's limited stock of manure should be given to the one kind, and not to the other.—*Ed. Farm. Reg.*

in the dry and sandy parts of Limburg, Anvers, and Northern Brabant, we would raise nothing but dwarf trees, which at the age of twenty or thirty years, perhaps, would be covered with mosses, and the growth of which would after that become more slow, and would soon afterwards decay. It is our interest then to bring these seeds from still colder climates and better soils, and from countries in which these two trees grow larger, viz.: from the Alps, Switzerland, the Tyrol, the mountains of Hartz, the Black Forest, and Norway.

The rule which I wish to establish will perhaps become very useful in introducing into this country foreign forest trees, for it is very probable that the little success with which we have met in this important part of the cultivation of forest trees is occasioned principally by choosing unsuitable countries from which to bring the seed.

[The foregoing communication well deserves the attention of all thinking farmers. If Professor Bronn's opinion is correct, we may make it operate beneficially on the practice of every farm, either for the correction of common errors, or the introduction of positive improvements, or for both. Very many cases of the proper application of this theory will readily occur, of which I will mention a few only as examples.

We frequently change our seed wheat, either from choice or necessity, and obtain new supplies from other, and perhaps very different soils—and we decide on the comparative productiveness of any two kinds, most generally, by their growth, as they stand in the field. Yet, according to the foregoing theory, the greater length and bulk of straw may be expected from seed that will yield a deficient crop of grain. By attending to the rule offered, we may make profitable selections of seeds from every single field, by taking from the warm and light soil, if we want the best product of grain, or the cold and backward, if the crop is of a kind to be most profitable in proportion to its whole bulk. Another necessary deduction is, that the farmers of lower Virginia ought often to procure new seeds of clover and other grasses from the mountains, or the northern states, to renew the original bulk and value of those crops, and to prevent their becoming more productive in seed than in hay. And the reverse operation will be equally beneficial as to wheat and other grains, of which the mountain and northern farmers ought frequently to obtain a new stock of seed from the plains and from the south. But even if such considerable changes are not attempted, a less degree of benefit may be obtained by attending to these rules within the limits of almost every farm.

A striking proof of the truth of Professor Bronn's opinion of the influence of climate on seeds is presented in the different times of maturing of the timothy grass of America and the cat-tail grass of England. These grasses are in appearance, and in every respect, precisely the same, except that the English grass is about two weeks later in maturing than the American, when both have been sown together on the same soil, Mr. Strickland made the trial, and states the result in his observations on the agriculture of the United States, reported to the British Board of Agriculture. This difference, which was so fixed, and appeared so remarkable to the observers, is completely explained by Professor Bronn's theory, applied to the temperate and moist summers of England, and the more heated air and drier soil of the United States.—Ed. F. R.]

REMARKS.

Professor Bronn's theory on the influence of seeds is, in the main, confirmed by many facts which have come under the observation of the writer of these remarks. Seeds or trees transplanted from northern to southern soils, mature their fruits earlier than the same species not so transplanted; and *vice versa*.

The northern summer is of short duration, and the progress of vegetation is consequently very rapid. Plants in such climates thus acquire the *habit* of quick growth and early maturity; and this habit is perpetuated for several generations in annual plants, and for one generation at least in perennial plants, upon removal to a southern climate. On the contrary, southern plants, having a long period in which to perfect themselves, acquire a slow growth; and this constitutional tendency is manifested in their offspring, when removed to a northern climate.

In the case of fruit trees, the varieties of the winter apple, introduced into Virginia from the northern nurseries, perfect their fruit early in autumn. It falls from the tree before the usual period of gathering, and is therefore of no value for winter use. The summer apples from the north come early into bearing here, and possess desirable qualities.

Nearly all our best varieties of peaches have originated north of us, or been introduced thence from foreign countries. The latest of any merit is the well known Heath, which ripens here about the 15th of September; in Baltimore from the 25th to the last of September; and in New York so late as seldom to develope its superior excellence. Our earliest peaches are also obtained from the north; for we have no native variety that ripens early in the season. The advantages of our climate are such, that we might have the peach in perfection from the middle of July to the middle or end of October; but as long as we depend upon northern sources for this fruit, we can never have any variety materially later than the Heath. Had the system of originating fruits been practised here and south of us to the same extent as elsewhere, it would have been practicable, by making judicious selections from various sources, to have the peach in regular succession, and in a high degree of perfection, for at least three months.

The northern corn, when cultivated in our climate, cannot be relied on to make a crop. The very early varieties, which produce soft corn for the table in July, may be planted for that special purpose with evident advantage. But for agricultural purposes, no variety of northern corn can produce an abundant yield in this climate. The hardening of the grain takes place in the month of August, the most critical period in the whole season. Those who attempted the cultivation of the famous Dutton corn, a few years ago, may recollect how utterly it perished during the heats of summer.

The northern wheat might be introduced here to great advantage. The influence of the seed extends through two or three generations, and the maturity of the crop is hastened by at least several days. Wheat usually ripens by or soon after the accession of hot weather, so that the effect of a change of seed is more beneficial than in the case of corn. While it is desirable to accelerate the ripening of the one, it is far from being so with the other. September is the proper season here for corn to mature.

All *early* vegetables are grown with decided advantage from northern seed. Gardeners who would have the earliest peas, beans, squashes, and other spring or early summer vegetables, do well occasionally to renew their seeds from reliable sources. But by exercising the greatest care in saving the earliest perfected seeds from their own grounds, most varieties may be preserved in their purity for a length of time.

The writer of these remarks has frequently exchanged seeds, both of useful and ornamental plants, with his correspondents at the north, and occasionally with those at the south. He has also received plants from various parts of the country. The facts above stated are derived from actual experience, and they are submitted as a practical illustration of the physiological principles asserted by Professor Bronn. P.

SOWING CORN FOR FODDER.

From the New Genesee Farmer.

Mr. Colman—In the Farmer for March, your correspondent, Ledyard, asks information on the subject of sowing corn, broadcast, for winter fodder. I was, at first, surprised at the inquiry, but on reflection, concluded he must have been a stranger to your paper, probably just then commencing an acquaintance with it. I ask leave, therefore, to refer him to your number for July, 1841, page 109. He will there find an article on the subject, that will, I think, in a measure satisfy his inquiries. I have been for twenty years accustomed to this culture, and have there given the result of my experience. I do not feel as if I could say too much in its favor. The product per acre, on a rich soil, and in a favorable season, will be very great. I have never had occasion to ascertain with accuracy the amount. But have considered, or estimated the amount, on different fields and in different seasons, to vary from five to seven tons, or more per acre. I have carried well a very large stock, rising 1000 sheep, and many cattle, far into January, with very little hay.

I would by no means suffer the corn to stand to let the ears ripen before harvesting. It should be cut when most juicy, when the juice is richest and sweetest. This will be, I suppose, at the time when the kernel has become nearly or quite full of milk. When sown 2½ bushels of seed per acre, the quantity which I recommend, and from which I would not vary, it will stand so thick and the stalks be so slender, that but few ears will set. Cut up at the time I propose, it will be so extremely succulent, that it will need to stand in small stouts to cure, during the dry and hot weather; and should be put into stacks, as recommended in the article referred to above, just before the fall rains commence.

The idea suggested in the Farmer for March, page 34, "that weeds will check its growth, if the land is rich, and fill the ground with seeds," I cannot think correct. It is entirely at variance with my experience. The ground is so deeply and perfectly shaded, that I have found nothing could live or grow among it, save the Canada thistle; and this would shoot up a slender, pale, weak, and sickly stalk, unable to produce or sustain a blossom.

I have been pleased, after taking off the corn, with the condition of the ground for cross-ploughing and sowing with wheat. I recommend to sow corn early, that it may be harvested early, and thus have the full benefit of the dry and hot weather, for the process of curing the stalk. If cut late, it will be more difficult so to cure it as to secure its safety. I once lost a large quantity, supposed well cured, by stowing it away in a large and solid mow. Of course, I prefer stacking it, as recommended in the article referred to above, around a pole, the length of a sheaf only from the pole, so that the butts shall all be exposed to the air. A FARMER.

April, 1842.

SLUGS DESTROYING THE COTTON CROPS.

A new enemy to the cotton planter has made its appearance in Panola and De Soto counties, Miss., in the shape of innumerable snails, which eat up and destroy the plant, commencing with the leaf and ending their repast with the bud. They are apparently the common-sized snail without a shell, such as may be found adhering to the bark of trees in wet weather. Several entire cotton plantations have been ruined by them.—*Compiler.*

This new and most destructive ravager, the naked snail, or *slug*, may be effectually and cheaply checked by sowing a few bushels of quick-lime to the acre, on the fields infested. See an article copied from an English journal, giving full directions, at page 216, vol. ix. Farmers' Register. This is one of the many cases, in which a little book knowledge, as much despised and disregarded as is such knowledge by farmers' and especially by cotton planters, might save hundreds or thousands of dollars to individuals, and millions to the country at large.—ED. FAR. REG.

THE FRUIT GARDEN.

By David Thomas, of Cayuga county, N. Y.

From the Transactions of the New York State Agricultural Society.

In traversing our wide spreading county, the pomologist must observe with regret that so few of the landed proprietors enjoy the luxuries of the fruit garden. The stately mansion, the comfortable farm-house, or the neat cottage, may meet his view in every direction; and well cultivated fields, loaded orchards, and abundant harvests, indicate that plenty reigns within; but if he stop and inquire for the finer fruits of the garden, what answer would he get? In nine cases out of ten, perhaps, their names would sound like the words of an unknown tongue; and the lord of the soil know as little about them as he does of the *lotus* of Lybia, or the *mangosteen* of India.

How many of our freeholders have ever tasted an *apricot*? How many of them cultivate the best *cherries*? How many know that delicious *plums*, always fresh from the tree, may be had from early wheat harvest till the ground freezes in autumn? How many eat the finest varieties of the *peach*? How many think of having "the circle of *pears*?

These questions if duly examined and considered, would show our deficiency—for deficiency, omission, or neglect it must be, not to provide for all the reasonable wants of our families. Now fine fruit in abundance would supply a reasonable want. The relish for it is prevalent throughout every class of our population—from the honored guest who regales on what is set before him, down to the school-boy who stops to plunder by the way.

Hundreds, however, may think, or say, "We have no time to attend to such trifling affairs." This plea might be allowed while a man was struggling to save his property from execution, or his land from the foreclosure of a mortgage: but from him who basks in prosperity, it would come with an ill grace. Every day comforts are not *trifles*. Luxuries which delight the palate, and conduce to health, are not *trifles*, yet well ripened fruits belong to this class; and we are satisfied that much suffering, and many a doctor's bill, might be saved by a plentiful supply.

It may be said indeed, that fruit often causes illness. So grain often causes founder; and cold water often causes death; but it is the *excess* that proves baneful or destructive. Half-ripe, crude, unwholesome fruits have no attraction for him that has free access to the fruit garden: it is the unfortunate wight for whom nobody has planted or provided, that incidentally suffers.

One hundred trees in most cases, would furnish an ample supply for a family, and may be selected in the following proportions:

15	cherry trees,	at 37½ to 50 cents.
8	apricot do.	37½
25	pear do.	37½
15	plum do.	37½ to 50
20	peach do.	25
5	nectarine do.	25
8	quince do.	25
4	early apple do.	25

The common nursery prices are added; and the annual interest on this sum, whether *borrowed* or *appropriated*, would barely replenish a tobacco box through the year.

Now a fruit garden containing this number of trees, ought to yield a constant supply of *cherries* for two months; of *apricots* for one month; of *pears* for nine months; of *plums* for three months; and of *peaches* for two months.

One hundred trees would do well on *half an acre;* but if we allow a square rod for each tree, the fruit garden would only be ten rods square. Now a lot of this size may be conveniently appropriated on every farm; and where is the owner who cannot build forty rods of fence? Let him listen, however; thorny shrubs would afford the best protection—not against quadrupeds, but Plato's "two legged featherless animals;" and the sooner such a hedge is planted the better.

Unfortunately for the moral character of our population, fruit is too generally considered lawful plunder. The culturist is allowed to have a full and exclusive right to his corn and potatoes—it would be infamy to steal them; but no exclusive right to his fruit—if they can get it. Thousands of honorable exceptions to this charge, indeed, may be found, but it is not the less true that a great part of our population is tainted, and deserves to be branded with reproach.

The native fruit of a thinly populated country, growing without culture, and free for all—has doubtless had its share in producing this laxity of morals. "I would sooner have a hundred Irishmen around me than one Yankee," was the declaration of a sufferer, whose fruit had been plundered near the lime of the Erie canal, when that great work was in progress. But Europeans are generally more exemplary on this point than Americans—shame on us! When Professor Stowe was in Prussia, where the roads are lined with fruit trees by order of the government, he observed a wisp of straw, attached to particular trees, to protect the fruit: a sufficient guard; but he suggested to the coachman that in America, it might only prove an invitation to plunder. "Have you no schools?" was the significant reply.

Yes, we have schools; but how many where the child is taught to respect his neighbor's property? Too often he acquires literature and vice at the same time. The State of New-York is famous for her schools and her prisons; the latter to supply the defects of the former system, which they do, however, very imperfectly. Better let the mandate go forth that the *morality of the Bible* shall be *one* of the chief objects of instruction. *Teach her children to be honest*, and then with science and literature, a foundation for true greatness and prosperity would be laid.

One thing is worth bearing in mind by those who purchase fruit trees: the *best kinds* are generally as *hardy as the worst*, and the difference in price fades into nothing when compared with the difference in *quality*. Nobody is satisfied with mean fruit after tasting better.

For a fruit garden, a western aspect is generally best, because it is the least subject to sudden transitions of temperature. Severe vernal frosts often prove injurious, or otherwise, according to the weather that follows. If the sky be overcast in the morning, and the air continues cold, little or

no damage occurs; but when the sun breaks out warm, the injury is greatest; and the most so, where the trees are most exposed to his rays. For this reason, a hill or a wood on the east side, may prove very beneficial.

A northern aspect would go far towards insuring regular crops of the peach, nectarine, apricot, if protected from the sun and warm winds by a belt of evergreens. On sandy soils especially, the reflected heat is often sufficient, in autumn or winter, to *start* the buds; and snow and ice have been successfully* heaped round the trees to prevent this disaster; but a northern aspect would probably render such labor unnecessary.

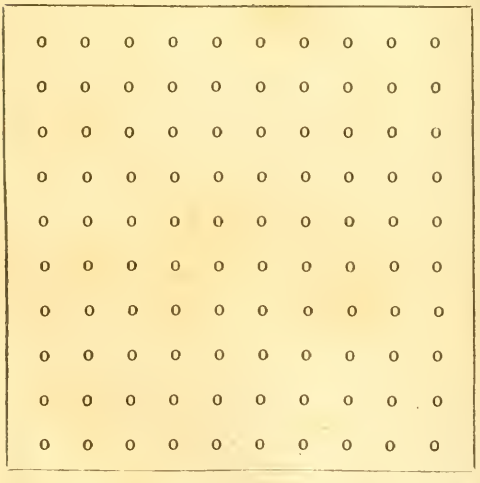
Dry firm ground should be chosen, preferring a sandy or gravelly loam, though clay will do with good culture. Wet, peaty, or spongy soils are apt to be frosty; for the radiation of heat is much greater than from firmer land.

Four *orders* of arranging or planting trees have been employed, which the annexed figures exhibit, all drawn by the same scale; and the distance between the nearest points (or trees) is intended for one rod. One hundred of these are represented in two of the figures; but in the *quincunx*, owing to the vacancies in the sides, only ninety-eight are given, while in fig. 3 there is a surplus, although some vacancies also occur at the sides.

The *first order* requires less calculation, and is more generally in use than any other; but in laying out the ground, the boundaries should be first accurately determined; and the lines may then be drawn across it with precision. No less care and attention in this respect, however, would be required by the other *orders*.

The *quincunx* fig. 2, is only a series of squares laid off diagonally; and we cannot perceive any advantage that it has over the common square, though it was formerly much in fashion.*

1



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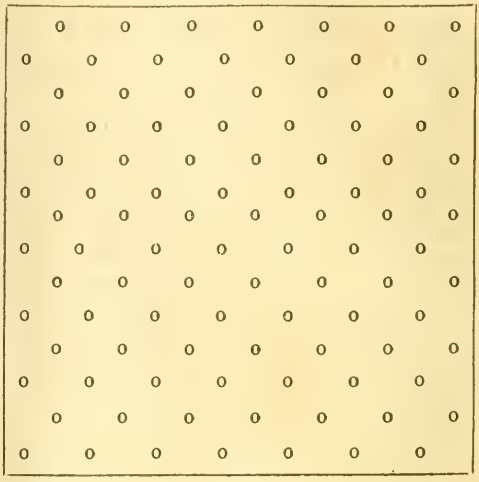

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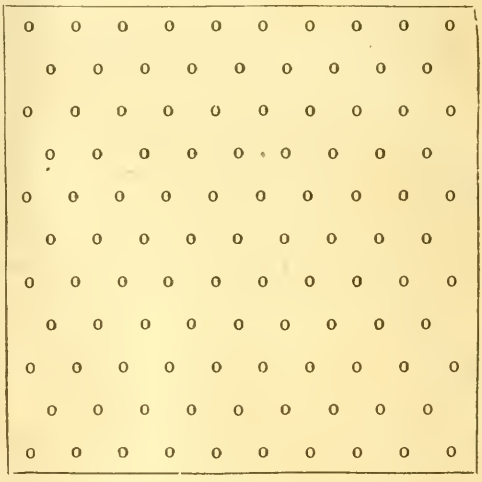
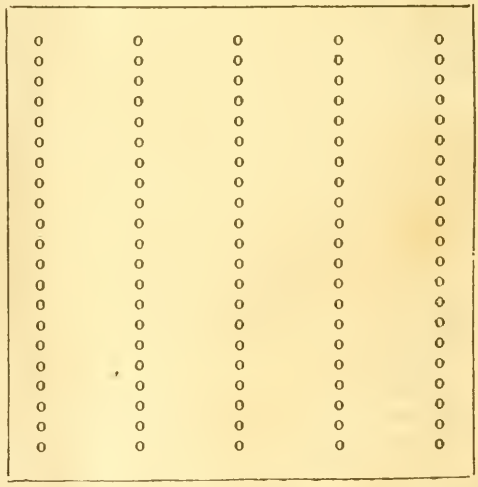


4



In the *third order*, each tree (except at the sides) is surrounded by six others, all at equal

* We caused an apple tree to bloom a fortnight later than the rest of the orchard, by piling wood round it.

* Pope said of Lord Peterborough,

"Even he whose lightnings pierced the Iberian lines,
Now forms my QUINCUNX, and now ranks my vines."

distances—in other words it stands in the centre of a *hexagon* made of six equilateral triangles. The trees are thus more equally distributed over the ground than by any other arrangement; and if cultivated by the plough, the furrows may be drawn in three different directions.

The *fourth order*, as explained by the figure, may be considered as rather a new proposition; but where a team is to cultivate the garden, the plan has some decided advantages. The spaces between the rows, are wide enough for the deepest ploughing, though it should be more shallow near the trees, and in no case come close enough to touch them. A lighter plough with one horse walking in the last furrow, however, may continue the work, and save much manual labor. And where nutriment is so near, the roots will soon find it.

To lay out the garden according to this plan draw the line for the first row, one rod from the fence; then leave a space two rods wide, and draw another line; and so on till the fifth row be completed, which will be one rod from the fence on the opposite side. This distance will allow room enough to plough between the trees and the fence, and for them not to hang over and tempt prowlers to reach the fruit on tiptoe.

Now 10 rods are 165 feet, and 32 substracted leave 133 feet, the distance between the first and last trees in the row. For 20 trees, 19 intervening spaces are wanted; and 19 into 133 give seven feet for each space. The trees though crowded *lengthwise*, will find ample room to spread *laterally;* and our experience is decidedly in favor of this method.

It has been found very useful to keep swine and poultry in the fruit garden, on account of their services in destroying insects, and especially the curculio. In many instances no other protection has been necessary; but where the garden is large, the *plum*, *apricot*, and *nectarine* should be planted in the same *quarter*, so that the hogs, if wanted, may be confined amongst them for a time. *Cherries*, and even *peaches*, would also receive benefit from their presence, though these fruits generally suffer less from this insect than the former sorts. Cherry trees, however, should stand near together, so that from a central seat, a load of shot may protect them. We do not mean that all birds fond of cherries should be destroyed, but only such as take more than a reasonable share, or that render no services in return.

Many people have a prejudice in favor of birds that no well balanced mind should entertain. "Denizens of the air," have no more right to our property than denizens of the earth. Plunderers on two legs are not more respectable than plunderers on four legs; and cedar birds are entitled to no more regard than rats, unless personal beauty can atone for moral deformity.

Ornithologists often become partial to the subjects of their study, and side with them against the farmer and the gardener—magnifying their services and overlooking their trespasses. The laborer, indeed, may drive the geese from his cabbages, throw stones at the crows, and even shoot a hawk—but not the birds that devour his cherries?

An amiable writer, in reference to such visiters, says, "Such has been the security they have felt in our grounds, and so great their increase, that not only *cherries*, *gooseberries*, and *currants*, but *apples*, *pears*, and *plums*, have been ravaged; and it may become a matter for serious consideration whether in continuing our protection, we do not risk the *total loss* of some of the most desirable appendages to the dessert." Now if called into council, our advice would be prompt and brief: Treat them according to their doings. Make pies of the robins, orioles, and cedar birds—one chicken is worth a dozen of them for business; but save and protect the blue birds, warblers, and sparrows—these are always our friends.

Stunted trees always produce smaller fruit than when the same kind grows on vigorous branches; but the fruit suffers in *flavor* as well as in *size*. The trees should therefore be planted in deep beds of fertile soil. In dry seasons, more especially, this provision is of great importance; and young trees treated in this manner are not only more likely to live, but grow much faster, bear much sooner, and bear much better fruit than on sterile land. All our observations go to justify these remarks.

When young trees are taken from the nursery, inquiry is often made how soon they will come into bearing? It is a very proper question, and it would be a proper answer to say: Very much according to the treatment they shall get. When they are set in holes cut out of a sod, just large enough to receive the roots with some crowding, and are then left to take care of themselves, we have no right to expect them to come soon into bearing nor to bear much when they do. Neither half starved cows, nor half starved trees will be found profitable. In the latter case especially, the interest on the purchase money is generally lost for some years, and not unfrequently the purchase too; but we hardly ever lose a tree in good condition, set in mellow ground which is kept mellow.

The holes for the trees should be not less than four feet diameter and fifteen inches deep, but a greater breadth and depth is desirable. Place the soil round the brink of the hole, ready for filling in again; but scatter the harder subsoil back out of the way. The hole should then be filled with the best earth, and rise a few inches above the general surface on account of its settling, first mixing three or four shovelfuls of chip-dirt with the part that is to come in immediate contact with the roots. It helps to keep the ground loose and moist, besides yielding much nutriment to the trees.

The roots of the trees when taken from the nursery should be carefully guarded against *drying* or *freezing*. If such care, however, has not been taken, bury the *frozen* roots in the *ground* before they can thaw, and plunge the *dried* roots with several feet of the main stem into *water*, to soak there from 12 to 24 hours, till the moisture is sufficiently restored.

In planting, spread out the roots carefully, and let the best point against the strongest winds. Fine or mellow earth should fill up all the spaces between the roots, so that every fibre shall come in contact with it on every side; and in order to accomplish this intention more perfectly, throw in a pailful of water when the roots are covered, to wash the earth down, and to fill up every interstice.*

* An experienced horticulturist says, nine-tenths

Newly planted trees being acted on as levers by the wind, often press the earth round their stems aside, and make an opening down to their roots, which in consequence suffer from both drought and disturbance. To prevent this disaster, it is therefore important that stakes should be provided to support and stiffen them. If driven before the trees are planted, they may be erect; if driven afterwards, they may be slanting; and in both cases, straw bands should be first wrapped once round to prevent the trees from chafing.

When trees are set in clay which holds water like a tub, they *soak* and often perish; especially if transplanted in autumn. This evil may be readily prevented, however, when the plough can be introduced, by drawing several very deep furrows where the trees are to stand, clearing out the loose earth with the shovel, and then employing chips, brush, potato tops, straw cornstalks, or old rails, in constructing an under drain. Even if made with these materials, it would last for an age, for when mouldered into earth, the water would soak away along the seam.

Early in summer, after the trees are planted, let the ground be well dug round with the spade, commencing shallow near the trees, but deepening as soon as there is no danger of disturbing the roots. One spading is worth several hoeings, though the broad hoe may be profitably employed once a month after the spade has thoroughly loosened the soil. Trees managed in this way, will grow much faster than if the ground were just scratched over to the depth of an inch or so; and many of ours have grown as luxuriantly through the late excessive drought, as if they were in want of nothing.

The pruning of young trees to prevent their *splitting down*, is a very important operation. Many are greatly injured, and sometimes ruined, for want of this precaution. Where the limbs diverge considerably, nature has provided a kind of net-work of the firmest wood to connect them together; but where two leading branches take nearly the same direction, they soon begin to press against each other; and the bark interposing, the wood is prevented from uniting. The consequence generally is, that when loaded with fruit, they are broken down by the wind. Now it is far better to cut off the limb in time. No material loss is sustained, as all the nutriment flows into the other branches, and increases their vigor.

The advantage of pruning apple trees, is generally known; and unless many of the limbs are cut out, some of the finest varieties become comparatively diminutive and insipid. The same care, however, is rarely extended to other fruit trees. When the twigs become stunted and mossy, sometimes they are trimmed by the tempest, or broken down by an untimately fall of snow; and then the benefits of pruning are manifest, even when done in that rough style. It is better, however, to depend on art than accident. As a general rule the best flavored fruit of the kind grows on the most vigorous branches well exposed to the sun and air; and with this idea constantly before us, we shall hardly do amiss when we apply the axe, the saw, or the chisel; though we may specify that cross branches should be lopped, and thrifty shoots that have room to spread, should be saved.

The tree mosses are parasitic plants, and should be expelled from the fruit garden. Lye is often used for this purpose on the apple tree; but we think it is no better than lime whitewash, which purifies the bark, and leaves it in a fine healthy condition. Once a year is quite sufficient.

Under deep snows, or snow drifts that settle round the trees, the *meadow mouse* often gnaws the bark to their great injury or destruction. This animal however always *works under cover;* and therefore the damage may be generally prevented by piling mellow earth round the stems, a foot high, late in autumn. The snow as it falls, is generally swept away from the pile by the wind; and even if the mouse should persist in climbing up on the earth—which we have not known him to do—he would soon come out into the open air, except when the snow was very deep.

Another method which has never failed with us, though requiring attention—is to *tread the snow firmly down round the stems;* and this should be carefully done every time that a deep snow falls, or whenever a drift is forming round the trees. The mouse, as he roots along, always turns away from the hardened snow.

Trees completely *girdled* by the mice, however, may be saved by setting grafts *early* in the spring to restore the communication between the two detached portions of the tree—in other words, by grafting them together. Part of a small branch should be *inlaid*, both above and below; and if skilfully done and carefully coated over with grafting mud or wax, it will be very likely to grow, except on the peach or nectarine. We have succeeded in this way on a pear tree; but three or four should be set round the tree.

Cultivated *cherries* belong to several species, which have spread into many varieties, and probably *hybrids*. The caterpillar sometimes feeds on the leaves; and the curculio punctures some of the fruit which in consequence becomes *wormy;* but no fruit tree yields a more certain crop, bearing every year without intermission, unless the blossoms or young fruit be damaged by frost. Some kinds, however, as the *morello*, have been nearly destroyed in some parts of the country by the "*black gum.*" This excrescence is caused by an insect which should be carefully sought for, late in the spring or early in the summer; and as soon as the bunches appear, the limb should be cut off and burnt.

The *slug*, another insect, feeds on the pulpy part of the leaf, despoiling its verdure and wasting the vigor of the tree. It might almost be mistaken for the filth of some little bird. It soon renders itself conspicuous, however, by its works; and though it sometimes attacks the foliage of other trees, the cherry leaf appears to be its favorite food. It may be destroyed by throwing fresh ashes among the branches by means of a shingle—every worm that is covered perishes. It has been done when the dew was on the leaves; but if the slug is moist enough of itself to catch the ashes, it would be better to apply them when the leaves are dry, because the latter would neither be injured by the potash, nor defiled by the dust.

The cherry tree is more impatient of *nuisances*

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of the deaths from transplanting arise from the hollows left among the roots of trees by a careless and rapid mode of shovelling the earth in about the roots.

than most other kinds. Some have been destroyed by ashes thrown round the stem. Under two trees, the pigs were fed with corn, and the cobs scattered over the ground: both perished. In a slight depression near another, the water collected in rainy weather, and the geese dabbled in it: the tree died the same summer. Lime whitewash has also been charged with injuring the cherry tree; and if it be used at all, the experiment should be cautiously conducted.

The *morello* and *Kentish* appear to be adapted to a greater variety of soils than the *heart* cherry trees; and may be employed as stocks for the latter in unfavorable situations. The outgrowing of the stock by the graft, constitutes no valid objection. We have never seen a tree endangered by such overgrowth, while the obstruction to the descent of the juices, favors the enlargement of the fruit.

The *apricot* was formerly ranked with the plum, but it differs enough to stand separate. Like the plum however, it has a smooth stone, and turns sour with heat; though in flavor it resembles the peach more than any of our fruits. It resembles it also in the excitability of the fruit buds in winter. Its earlier bloom exposes it rather more to severe weather in the spring, but generally it succeeds wherever the peach can be successfully cultivated. In this climate, the tree is perfectly hardy.

There are two species of the apricot: the black, and the common sort, which has spread into many varieties. Ripening earlier than the peach, their presence in the fruit garden is very desirable.

Neither the borer nor the caterpillar attack the *pear* tree; but sometimes flies, wasps, and hornets are busy among the leaves, showing that all is not right, and that honey dew emitted by plant lice, attracts them. But this tree is subject to a more serious injury, to wit: the *fire blight*, which occurs early in summer, the leaves from the extremity of the branches for two or more feet, appearing as if they were *scorched*. We think however, that two distinct causes occasionally operate to produce similar effects, namely: insects, and a starting of the bark in winter.

The late Professor Peck on examining the branch of a pear tree which had died with fire blight, said the damage was caused by an insect (*Scolytus pyri*,) and that to cut off the limbs a foot or more below the dead part, and *immediately burn them*, would be the proper remedy. We have faithfully followed this advice; and though the fire blight has been several times in the fruit garden, its ravages have always been arrested at once, so that we have not lost a tree from this cause in twenty years. We have believed that the new colonies went with us when we carried off and destroyed the branches.

The starting of the bark in winter, appears to be caused by an untimely flowing of the sap, followed by intense cold, which expands it into ice, and separates the bark from the wood. We have observed such effects once or twice, succeeded on some of the smaller branches by a blighting of the leaves, but we believe it seldom occurs in this district.

The *plum* tree is sometimes, though rarely, attacked by the *peach worm* in western New York. Its most formidable enemy, however, is the insect that causes the "*black gum*," similar in its effects to the insect that destroys the morello, if they are not identical. Be this as it may, it is rapidly increasing; and unless our farmers shall turn over a new leaf, the plum will soon become very rare amongst us. In every direction that we travel, branches are loaded with these excrescences; and if there is one man within fifty miles of us who has done his duty, we should be pleased to hear it.

To guard against this insect, the trees should be well pruned, though not enough to check their vigor, so that the *bunches* may be readily discovered. Unless this precaution be taken, it would be very difficult to find all of them, without spending more time than people in general have to spare. Let there be no delay in cutting off and burning them when they are found.

It appears that the eggs of this insect are deposited in a slit of the bark some time during the summer, and where they generally pass the winter without hatching. Soon after vegetation commences in the spring, a kind of fungous wood is formed, swelling out on one side of the branch, and amongst this the young progeny finds nourishment and shelter. This fungous wood, however, appears not to be occasioned by the worm, for it often occurs where there are none, but by some irritating secretion from the parent.

After the late severe drought, when the trees took a second growth, we found several *new* excrescences so late in the season that probably the worms would have perished with cold if we had not arrested their career. Does the starting of the fungous wood cause the eggs to hatch?

We have spoken of insects that depredate on the *tree*: we now turn to such as injure the *fruit* by puncturing, and then depositing a nit, so that it becomes *wormy*, and drops prematurely from the tree.

Every person that cultivates the plum, apricot, or nectarine, ought to be acquainted with the *curculio*, both by sight and by character. There ought to be a good drawing of this insect, but we have seen none; and at this season of the year we cannot have one prepared. It is however a dark brown bug, about a quarter of an inch long, and of singular form, having a slender neck and head. When it drops from the tree, it lies still, pretending to be dead; or if a dried blossom or leaf be near, where it can hide, it moves cautiously under, fearing to be seen in motion. When crushed between the thumb and finger, it feels like Indian meal, and like no other insect that we have examined.

It is timid; and when hogs, sheep, or cattle pass frequently under the trees, it is scarcer than in more retired places. Trees that stand near a door where there is much passing are often entirely exempt from its visits; and the same result occurs where they stand in a lane or barn-yard. The late Thomas Forrest, of Germantown, near Philadelphia, tied one end of a cord to a plum tree, and the other end to his pump handle, so that it shook the tree whenever they drew water. It saved the fruit.

This insect on one point is very sagacious. It is unwilling to have its progeny drop on a pavement, or into water. The same shrewd horticul-

turist set his nectarine trees leaning over the fish pond, and not a curculio disturbed them. In regard to pavements, we have had several accounts of their efficacy. A friend of ours had his plums to ripen perfectly over a pavement, while others, without this protection, though otherwise favorably situated, were entirely destroyed.

Only a few trees, however, can be guarded in this way. For the fruit garden, we want something more comprehensive, and have already referred to the services of swine and poultry. They devour much of the *wormy* fruit, and the young curculios along with it; but some of these insects probably escape, besides all such as leave the fruit before it falls.* How long they live is not known; but if we may judge from their difference in size, it may be many years; and to this company the new brood is annually added. Unless the swine and poultry, therefore, can induce them to migrate, the fruit must suffer greatly from their ravages, and such has been our experience.

Finding many of our trees nearly unproductive, we determined in the early part of last summer to call these depredators to account. Accordingly we followed the same plan that we recommended some years ago in the New York Farmer:—spread sheets under the trees, and jarred the branches violently. The little marauders, taken by surprise, fell down by dozens; and the contrast of colors, enabled us to detect them at a glance. We chose the cool of the morning for this purpose, when they were slightly benumbed; and persevered till we had destroyed nearly 1700. In consequence, all the trees that we visited bore fruit in abundance; and to prove that our labor was rewarded, a tree that was overlooked bore three apricots, while another of less size bore a half a bushel.

During its migrations, the curculio doubtless uses its wings; and near its native spot it may occasionally fly into the tree; but from several circumstances, we conclude that it generally ascends by crawling. With this belief, circular tin troughs have been fastened round the trees; and being filled, and kept filled with water, have been found useful—for this insect is no navigator. These appendages however, should be applied very early in the spring, before it gets up the trees. Afterwards they are not likely to be of any benefit whatever.

When the earlier accounts of the curculio were published, it was believed to be identical with the worms that infest the apple, pear, and quince; but Noyes Darling of New Haven, more than ten years ago, discovered that they were very distinct; and we repeated his experiment with the same result. It is a dark gray miller that attacks the apple and the pear, and probably the quince. It was also thought that the curculio continued its ravages until autumn; but the same sagacious horticulturist found that its work was finished before midsummer.

The mark which it leaves on the fruit that it punctures, is in form of a crescent; and we have never seen that mark except on stone fruit.

The *down* of the *peach*, generally protects it against the curculio; but the *nectarine*, which is only a smooth skin variety of peculiar flavor, often suffers even more than the plum or the apricot.

The *peach worm* (*Ægeria exitiosa*) attacks the tree at the root, where the bark is soft from the moisture of the ground, or the shading of grass; but it avoids the hard scaly part, so that old trees are often undisturbed for years. On the reverse, young trees are much injured by it, and sometimes destroyed, especially where two or more are at work at the same time. If they encircle the tree, there is no hope of its recovery, but this is rarely accomplished by one worm.

Though it feeds on the pulpy part of the bark, it seems careful not to disturb the cuticle, so that were it not for the gum and filth mixed together on the outside, it would be difficult to find the depredator. The fresh filth, however, sufficiently indicates its presence. By entering a knife at that point, and slitting the cuticle longitudinally, the establishment is soon broken up, for it is seldom four inches in length; and then we discover a white grub three quarters of an inch long, which is readily extracted. When it is removed, the tree speedily recovers.

Some persons remove the soil to the depth of two or three inches, and apply hot water, hot soap suds, or warm brine, at any time in autumn or spring when the ground is unfrozen; and if the gum be also removed, so that the fluid can enter the hole, the worm is sure to perish.

Various methods have been employed to *prevent* the attacks of this insect. In the spring, earth has been piled round the tree a foot high, covering up all the bark that was tender. With the same object in view, canvass or ropes made of hay or straw, have been wound about the stem, and then coated with whitewash. Straw in an upright position has also been applied. Tan in small boxes has answered the same purpose; and its properties are also repulsive. Lime and ashes have the same effect. Common salt, either alone or mixed with nitre, has been found efficacious, besides promoting the growth and productiveness of the tree. Half a pound has been scattered round it at a time. Soot, employed in the same way, is highly recommended. A small red cedar, planted in the same hole with a peach tree, has protected it by its offensive odor. Charcoal in small pieces, heaped up, is supposed to smother the worm by choke damp, and sulphur to poison it with its fumes. Doubtless all are useful, but the appendages should be removed when the warm season is over.

Sometimes a worse evil than the worm, however, overtakes the peach tree. This malady was named, by the late Judge Peters of Pennsylvania, "*the yellows*;" but the leaves are not always yellow, as the name would imply. A more certain indication is the premature ripening of the fruit, with purple discolorations of the pulp, and deficient flavor. As the disease advances bundles of slender twigs protrude from the larger branches, and increase till the vital energy is exhausted.

This case is perhaps the only instance of a contagious disease among vegetables, communicated by contact of the roots, or the application of pollen. That such are the facts, indeed, has not been directly proved, but the circumstantial evidence is strong and pointed. Young, healthy

* Last summer, we observed several cases of this kind where the larvæ had escaped through small holes in the sides of plums and apricots.

trees, speedily decline when planted among diseased roots. Frequently, the first appearance of the premature ripening is confined to a solitary branch, when no trace of the disease can be found in any other part of the tree. When this happens, it is prudent to amputate immediately, although it is doubtful if the tree itself can be safely left to stand till it blooms again. In particular cases we have pruned closely, destroying the blossom buds, and giving it a chance for recovery, without endangering other trees; but we would not recommend it as a general rule, but extirpate the tree in due time.

It is certainly known, however, that the disease can be communicated like the smallpox. We have set buds from sickly trees into healthy stocks, and all have perished in the course of the year. Yet different degrees of virulence, perhaps depending on the stage of the disease, are observable.

There can be no doubt that on a sickly tree, the pit or kernel is as much affected as the pulp that surrounds it; and therefore such stones ought never to be planted in a nursery. A peach tree not attacked by worms, and free from this malady, ought to live at least 50 or 100 years; and we believe no reason whatever, except the two just mentioned, can be assigned for their early decay. If the worm is not at the root therefore, when the tree is sickly, we may conclude it has the yellows; and that this disease, if the pit was tainted, has

"Grown with its growth and strengthened with its strength."

Some varieties of the peach and nectarine, are subject to a *white mildew*, which appears on the new shoots about midsummer, checking their growth, but not attended with any other ill effects. It seems analogous to the mildew on the grape and gooseberry; and may be cured (it is said) by the application of sulphur water. A better course, however, for culturists in general, would be to stimulate the tree to make a handsome growth in the early part of the season, and to take no further care.

This disease appears to be exclusively confined to Lindley's *first class* of peaches and nectarines, "whose leaves are deeply and doubly serrated, having no glands." Some varieties of this class, however, suffer very little; while others, such as the early Anne, are much impeded in their growth.

The peach is justly considered the most delicious fruit of the temperate zone; and yet it is scarcely known in a large portion of the state of New-York, which we have much reason to believe would admit of its successful culture. Not only in the high lands between the Cayuga lake and the Susquehanna, but also in the elevated region between the Great Bend and the Blue Mountain in Pennsylvania, this tree has been found healthy and fruitful. We saw several in fine order, the very next season after some had perished with the cold in the low and beautiful valley of Stroudsburgh.

To some persons this statement may appear like a paradox. But what are the other facts in this case? Warmth in winter is pernicious. It starts the sap, swells the bud, and the intense cold that follows destroys bud and branch. On the contrary, the steady cold of the hills is conservative. The bud is so exquisitely folded and prepared for a severe season, that unless it is disturbed by the sap, it is safe from the greatest cold of our latitude. Like the seeds of the melon, or a grain of corn, it appears to be too dry to freeze.

In the middle districts of our state, let horticulturists therefore remember that the hills are more favorable to the peach than the valleys; and if their labors are unrewarded in the low precincts of their villages, let them occupy the neighboring heights, and lay out fruit gardens there. Let them also remember that many trees and shrubs which are hardy in a dry rocky soil, perish with the cold in a rich border. In the latter case, the wood is not sufficiently matured, and the frost strikes it when it is full of sap, like a weed. To crop the ends of the peach shoots, when they grow too late, has been useful—not so soon in the season as to start the buds, but as soon as that danger is over. We have alluded to the loss of the fruit buds in winter, and the early bloom of this tree. These two causes render the peach a more uncertain crop than the plum or the cherry; but particular circumstances, perhaps not well understood, have had an influence on its productiveness. Where trees stand in the same immediate neighborhood, some are barren while others bear; and a belief is becoming prevalent that grassy ground is most favorable. Though we are not entirely prepared to decide on this point, yet most of our observations lean in that direction; and if it be proved, an exception to our plan of managing the fruit garden ought to be made on behalf of the peach, nectarine and apricot, as soon as those trees are of full bearing size.

Some years ago, we drained a shallow swamp; and though the situation is high and airy, peach trees of the *best bearing kinds* planted there have always been unproductive. Now the annual cultivation of the soil, doubtless, rendered it *more spongy*,* and consequently *more frosty*, because it radiated more heat than the paler and firmer ground. But was this the *only* cause? and if so, did it cause the destruction of the buds in winter, or in the spring?

One fact, however, should not be forgotten; To accelerate the growth of the peach tree when bearing, by either culture or pruning, endangers the fruit. In summer, therefore, the soil should not be disturbed.

The *quince* tree as well as the apple tree is subject to the attacks of the *borer*. The larva of this insect, resembles the peach worm; but it cuts through the solid wood, and therefore is much more difficult to extract. With a barbed wire, we have often succeeded, and sometimes failed. In a young tree that had been neglected, we found them so deeply entrenched, and their holes so winding, that they kept possession. We then made a small auger hole through the heart of the tree, and filled it with sulphur. A few days after we found one of them in a dying state, and no more filth was ejected. Quince trees should be examined on this account at least once a year.

As the pear tree is not infested by the borer, it has been employed as a stock for the quince tree,

* Would the increased radiation from this cause be counteracted by spreading straw chaff or shavings under the trees?

and if budded or grafted a foot or more from the ground, it must generally be safe from such attacks.

The quince tree like the pear tree, however, is subject to *fire blight*; but only a few inches of the ends of the branches suffer. Whether this appearance is owing to the more stunted nature of the tree, or to a different insect, is not positively known; but as it is probably caused by an insect, it would be prudent to cut off the dying tops, and burn them.

Though *winter pears* have something like a determinate time for ripening or becoming soft, yet this period may be accelerated or retarded, by increasing or diminishing the temperature of the place where they are kept. Our experiments on this point within the last year, have been very conclusive. Pears of a sort that had continued hard until spring in a cool cellar, have ripened towards the close of autumn, in a warm room; and by placing them in different temperatures, the season for each particular kind may be greatly extended.

When *winter fruit* is buried in the ground for long keeping, it should be placed in a box, or on a bed of straw, and be well covered with the same, so as not to come in contact with the damp earth which causes it to swell, crack, and lose its flavor; and to prevent it from becoming musty, it should be kept in an out-house, till the ground begins to freeze. We have never known fruit to be damaged that was treated in this manner, and then timely removed in the spring.

Greatfield, 12*mo.* 17, 1841.

REMARKS ON DRAINING, AND PARTICULARLY SMITH'S DEANSTON SYSTEM.

Extract from the London Farmer's Magazine.

The present practice of subsoiling is an excellent one, when the land is sufficiently drained; but I am afraid it will only be a fashion of the day, because it is not new. In an old work on agriculture, there is a plate of a subsoil plough, exactly similar to Mr. Smith's plough, and was used for the same purpose. The only difference was in name, as it was called a "resurrection plough." Before this plough be put to work, the drainer must finish his; and I will now say a little on this subject.

The newest fashion in draining is called the "Deanston thorough and frequent system." To hear some talkers and writers on this subject, particularly those who talk and write by a snug fireside, with a bottle of wine before them, one would suppose draining was unknown in Britain before Mr. Smith commenced upon his farm. I have read his work on the subject, and have heard some of his speeches, and I consider him to be a very sensible man, and a good practical farmer; but, notwithstanding, I am going to find a little fault with his draining. I have been a drainer myself more than thirty years, and upon the frequent system too. It is the fault with nearly all drainers, whether with the pen or in the field, that they have each one particular system of their own, and that they consider this the only proper one for every part of the world. Had I never drained any but my own native farm, I should most likely have erred the same way. In my practice I have drained land which had, at some former period, been drained exactly upon Mr. Smith's principles; of course the present fashion is only an old one revived. Some time ago "Elkington's system" was the leading *ton* in draining. His system was quite opposite to Smith's. He would drain a whole farm, or district, with a single drain. His system was adopted in this neighborhood; and the only effect it had was drying up some of the draw wells, which had to be sunk deeper to get the water again. With the surface of the land, it made not the slightest difference, yet I have seen cases where it has drained the surface.

Now, from my own experience, I have learned that no one system will produce the best effect on every description of land at the same cost; and this is what should be the aim with all drainers. I say, let me see the land, and not only examine its surface, but the subsoil, and, in some cases, the adjoining lands also, before I conclude on the direction, the depth, or the distance of the drains. I am quite of Mr. Smith's opinion, that a great breadth of land requires draining, which is considered by most farmers to be sufficiently dry. He recommends that in every case the direction of the drains should be right up the incline of the land. There are cases when I should do the same, because I know there are cases when it will and has answered; but generally I should not do so, because I have frequently seen it practised where it has not answered or produced a proper effect. His arguments for taking the drains up the incline of the land are—1st, "Because the strata is cut longitudinally, and by a drain directed down the steep, the bottom of which cuts the stratum to the same distance from the surface, the water will flow into the drain at the intersecting point of each sheet or layer on a level with the bottom of the drain, leaving one uniform depth of dry soil, because the stratification generally lies in sheets at an angle to the surface." Now, "generally," I have found in this country, that the stratification lies in sheets horizontally to the surface; and whenever this is the case, it is quite clear that a cross drain will drain more land effectually, than one up the incline; and to drain the land effectually, with the fewest drains, is a matter for serious consideration with every farmer.

Mr. Smith's second argument for pointing his drains up hill is, that water can run off quicker; for he says, at page 10, "whereas cross drains having little declivity, are often filled high up with water for years before the mischief is discovered." Now if there be a little declivity, the water will run off. It is where there is no declivity when the water stands high in the drains. This is the fault of the drainer, not of the system. Again he says, "it is quite necessary to fill drains directed down the steep, with stones of small size, or with danders or gravel, to prevent the current of water from cutting or running the bottom of the drains." He first directs his drains down the steep to make the water run off quicker, and then fills them with small stones to make it run off slower. Now, whenever the strata lies horizontally to the surface, I should run my drains across the incline, but with such a fall into

the main drains that the water would neither stand in the drains, nor run off so quick as to injure the bottom of the drain. In four cases out of five, the cross system is the best, and as land is generally ploughed up and down hill, every drain runs across the furrows, which always answers a better purpose than in the furrows. In short, I should never have high crowned ridges where the land was properly drained.

Now, sir, for broken stones instead of hollow drains. I have seen drains taken up which had been filled thus, perhaps one hundred years ago, and were running tolerably well; I have seen others taken up, which, from the state of the land, had perhaps been run up one hundred years ago. I should, therefore, say that in some kinds of land, or in some situations they may and do answer; but in every situation I should save the trouble of breaking them for strong or clay land; and when I could get stone suitable, I prefer flat stones set on edge to the firm land, and one edge of the corners set to the opposite side and reared to the other, in an inclined position, and forming a triangular drain. At top of the corner, I should put hedge dressing, stubble, croppings of trees, or under wood or gravel, small stones or cinders, between and the surface soil. I should not put any clay in again. If the stones were rough I should adopt the same plan, but cut the drains a little wider. If I used tile I should prefer them made flat instead of arched, and form triangular drains in the same way as with flat stones.' In a great number of our coal districts in this county, a broken stone drain would not remain open two years. There is a mineral substance in the soil, (oxide of iron, I believe,) with which the water is so impregnated as to choke the drains, if made of broken stones.

Mr. Smith says, that by the up-hill system, or his system, or what I call the old system raised from the dead, a less length of drains is required to drain an acre of land effectually, than by the cross system; and of course, if sunk no deeper, must cost less per acre. I think I can prove from his table of distances and expense, that as the lawyers say, he has not made out his case.

The distance he recommends for stiff clay subsoils is from 10 to 15 feet; for sandy clay subsoils, from 15 to 20 feet; and so on up to 40 feet, as the bottom is more open and porous.

Now, except Mr. Smith can drain land perfectly dry, with drains at greater distances than these, there can be no benefit whatever in his system; but, on the contrary, a loss. By taking the drains across the incline of the land, four acres out of five, or more, of clay land in this county, would be made perfectly dry with drains, at 15 to 20 feet distance. Very little land would require them so near as 12 feet. But, suppose by taking them across the incline, the land required the drains at the same distance as if directed up the hill, what advantage is there in point of expense? To prove which is the best system on the same land, the drains must be at equal distances in both systems, and in this case the length per acre will be the same in both cases; consequently, the expense would be the same, for both systems require leading drains. One system requires them up-hill, and the other along the bottom of the hill or field.

It does not appear from reading Mr. Smith's work, that he has had any experience in draining on the cross system; of course, what he says against it arises merely from his ideas, or from seeing draining on that system badly executed. Most of the objections he raises against it, may be raised with equal truth against his own. Others are no objections at all, as they arise from the ignorance or carelessness of the drainer, not of the system, and the same ignorance or carelessness, would do the same mischief in any system of draining.

At page 6 and 7, Mr. Smith gives the names of a number of respectable agriculturists, who have "astonished the natives," with the superior crops they have got after draining upon the Deanston system. Now I feel quite convinced that draining was the primary cause of those superior crops; but I will venture to say also, that the benefit arose more from the number of the drains than the direction of them—the "frequent" system, not the Deanston system. I have proved the great benefit of the frequent system 30 years ago; I am acquainted with two farms drained on this system; one of them was drained ten years before I was born, and the other about ten years after. The drainage of these farms is as perfect now as at the first. The inclination of the land on one is very considerable, and in a part of the other.

I am acquainted with a considerable portion of Ayrshire, and I will venture to say that more than three-fourths of it would be drained as effectually at from one-eighth to one-sixth less expense by the cross system, than by the Deanston system.

A gentleman who resides at no great distance from Manchester, drained a quantity of clay land about ten years ago. The drains were put in a right direction for the land, which had not much inclination, but they were laid at too great a distance from each other. They were also very expensive ones, as they cost quite as much as would have made three times the number, which would have been about the proper distance. The manager was a young Scotchman; and, like most of his countrymen who come here young, thought he knew more of agriculture than all the farmers in Lancashire put together; of course, he would not be taught. After a number of years, the proprietor of the land seeing the draining was imperfect, and taking in some *La Belle Assemblée* of agriculture, and seeing there the newest fashion of draining just come down, not from Paris, but from Perthshire, he commenced two years ago, draining the land over again upon the newest fashion; namely, up hill, every furrow, and with broken stone. In March 1840, I was in that neighborhood, and seeing the men at work, I went to see their operations. The ridges were 10 feet wide, of course the drains 10 feet asunder. The men were breaking stones which were beautifully adapted for triangular drains. Now, the subsoil in this field was a very good one for draining, and drains at 21 feet distance would have made excellent work, and would have cost little more than one-third the expense. Some parts of the same estate, to make gook work, would require them at 12 feet distance; but all were served alike. In the above field I showed the workmen that the old drains, across of the incline, drained full 21 feet. I found they were not very anxious to point this out to

their master, and the young Scotch agent had left some years before. Now, there can be no doubt but this land will be perfectly drained; and we shall no doubt see a fine written letter in some fashionable agricultural publication. The letter will describe, in glowing colors, how imperfectly the land had been drained by the cross system with hollow drains, and the most extraordinary effects produced by the "Deanston system;" never taking it into consideration, that it has been the multiplicity of the drains on the latter system which has produced the effect. This letter will be read by amateur farmers, and at some cattle show dinner, some one of these will beg leave of the chairman to propose a toast. This will be prefaced by a flourishing speech on the great national benefit to be derived from the above system of draining, coupled with subsoil ploughing, and which, if generally adopted, will soon be the means of paying off the "national debt," and will end with proposing to drink the health of Mr. Smith, with "all the honors, *three times three, hip, hip, hip, hurrah!* for Smith and the Deanston system of draining." At most of the agricultural dinners I have been at of late years, there has been a great quantity of draining done, both theoretically and practically. The former has been applied to the land, and the latter to the bottle.

A new tenant upon a farm in this township, drained a field of wet clay in February 1840. The field had been oats the preceding year, and the old tenant had allowed the cattle to graze on the field all winter, consequently it was very much poached, and when the draining commenced every hole was full of water. The person who laid out the drains was a little inclined to the "up-hill system" in every case; but knowing I had drained a considerable quantity of land, he asked my advice, which he followed except in a part of the field. In this the drains were taken up the incline. The drains were all laid with tile, and at a distance of 18 feet. When the drains had been open about ten days, I went over the field, and where the drains had been made across the incline, every hole made by the feet of the cattle, and which were full of water ten days before, were now quite dry and the land firm to walk over; while on that part where the drains were made up the incline, the holes still contained water, except those near the drains, thus evidently showing that the cross system was the best by the quickness in which it took the water out of the soil.

Another tenant drained a field in the spring of 1841, which had an incline of about ten degrees; the soil strong, and the subsoil clay and sand, and lay in such a manner as inclined me to think it would drain quite as well, if not better, by the "up-hill system." However, half of the field was drained upon one system, and the other half on the other, by way of experiment. The drains in both cases were made at 20 feet distance, 33 inches deep, laid with tiles, and cinders upon the tiles between them and the surface soil. The field appears to be perfectly drained upon both parts, but next year's crop will afford means of testing the matter more accurately.

Now it appears very clear to me, that the great success of Mr. Smith's system lies in the number of the drains, not in the direction in every case, or in being made of broken stone; for, by the number he puts in, the land would be drained, whatever direction they were put. But I repeat that the object with every drainer should be to give the drains that direction, and that depth, as will drain the land perfectly dry with the fewest drains; and to do this, there can be no rules laid down in books, except general ones.

Draining is of the first importance to agriculture. There is no saying what England may yet do by a general drainage, with a proper use of the plough, the hoe, and the dung cart. I am, sir, yours, very respectfully.

W. ROTHWELL.

Winwick, March 1st, 1842.

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EDMUND RUFFIN, EDITOR AND PROPRIETOR.

CHOICE OF LANDS.

(Continued from page 233.)

From the South Western Farmer.

Poplar, which is common in our river counties, denotes land of the first class—none have stood cropping so long or retained their fertility so well among us as the poplar lands. We know of tracts which were opened in the old Spanish times, and have now been in regular cultivation, without rest or rotation, for more than half a century; and yet, where level enough to prevent the original surface from having been washed off, these lands seem scarcely diminished in fertility. The soil where poplar is the predominating growth is an unctuous, black mould, about a foot in depth, resting on a substratum of red clay. It has a sufficient quantity of sand with much lime in its composition, and is easily cultivated, and never bakes or becomes cloddy. These lands, however, notwithstanding their superiority for cotton and other crops, are said not to be so well adapted to corn and small grain—being inclined to force up too much stalk and leaf without a due proportion of seed. On the very best lands poplar will be the predominating growth. On that of a medium quality it will be seen mixed with other trees—beech, hickory, oak and even pine. Wherever seen however it denotes superiority, as it never grows on poor land. It never grows either in swamps or overflowed bottoms, and therefore indicates dry uplands. The tree is not difficult to deaden; and the timber is among the most valuable we have—making most superior lumber and working with great ease. The heart, or the black or yellow part of the tree however is the only valuable part. The sap is hard to be worked and soon rots. The heart is very lasting even in the ground.

Pine.—Of this we have only two varieties—the long leafed and the short leafed yellow pine. Land with little or no other growth but pine is the poorest sort; yet such is the effect of our climate that even such lands, which in other regions would be nearly entirely barren, here will bring tolerable crops of corn and small grain, and very superior crops of that great security against want in our poorest sections—the sweet potato. Scattering pines of large size will be occasionally seen on rich lands and heavy bottoms—but a small growth with no other trees intermixed denotes a soil as near sterility as any land among us ever approaches. Pine is deadened with difficulty, and unless fired scarcely ever dies completely the first year. The timber is of very unequal value. The long leaf is softer, drier and more lasting and altogether the most valuable. The short leaf is more watery, harder to work, and peculiarly liable to rot.

Persimon, we believe, indicates no particular character of soil. It is seen growing on poor and rich—on high and low alike.

Pecan, is a growth found chiefly in swamps, subject to overflow; though it is occasionally found on high and dry locations. In such places however it always has a stunted growth. In the swamps it is one of the largest of trees. The timber is valuable for rails and fire wood and is tolerably lasting. It has a texture between that of the hickory and the ash.

Pawpaw.—This graceful and beautiful shrub is seen only on rich spots. It will not grow on land deeply overflowed, though frequently seen in bottoms. It bears a rich and abundant fruit of a peculiar aromatic and luscious taste, but which is rejected, we believe, by all other animals except man.

Palmetto.—This is a plant seen rarely on high land. It grows most commonly on rich bottoms, not liable to deep and regular overflow; and yet not above it. Palmetto bottoms have been found to be extremely productive, and it is considered, next to cane, the best indication of good land in the swamps. Palmetto is very useful for making most durable and cheap roofs for cabins, and of the young leaves, which are white when they first appear, the cheap summer hats and bonnets so much in use are made.

Rushes, the singular, marine-looking stems without leaves—hollow and of a deep evergreen, which are seen so frequently in the bottoms of the Mississippi, indicate, like the palmetto, land of a medium elevation. Stock are extremely fond of it, and it is fast disappearing wherever they are becoming plentiful.

Sassafras denotes, when of large growth, rich land, generally above over-flow. The sprouts are continually shooting up with the persimon, on our thin lands—but they never attain any size, and in old fields, soon have to give place to oaks or pines. The timber is very easily worked, soft and easily split. It is peculiarly valuable for shingles, and is very lasting in any situation.

Sycamore denotes low-land, though it is not often seen in the swamp of the Mississippi. It is never seen on poor land. The timber is scarcely ever put to use among us.

Vines.—As a general rule, vines of a large size and plentiful denote superior land. In overflowed bottoms, the vines of all sorts become more tangled and thick, spreading out nearer the ground, and of a smaller and more spindling growth. The large grape vines, swinging from high branches, clear of the trunk of the trees, and free from the tangled branches near the ground, denote very superior land above over-flows. No vines of large size are ever found on poor ground.

Walnut, of large size and plentiful, denotes land of the first class. It never grows on either poor or overflowed land. The tree is easily deadened, and the timber is very valuable, and lasts extremely well in any situation. We here have only the black walnut. The white walnut or butternut is not seen in our latitude.

Willow, it is well known, grows only on low wet lands. The basket or golden willow is a sort which grows well in almost any situation, and is calculated to be of great value in the manufacture of cotton baskets.

We have thus gone over the most common growths among us, and endeavored to point out the qualities of soil they respectively indicate. In conclusion, we would say, if land in the interior is wished, make poplar and walnut the first trees to be sought for. If you cannot get land with those—look for ash—magnolia—sassafras, of large size—beech, or large sized white oaks. As a third choice, take land with large red oaks and hickories. If you want a dry sandy soil, look for scrubby black jacks and hickories—if a tenacious wet one, look for post oaks or willow oak. If you go among pine, take first the land which has large trees, scattering and intermixed with other growth—and leave as the last chance such spots as grow no other tree, particularly if they are small. If you go into the swamp—look first of all for what are called the cane prairies—spots covered with cane of a large growth, with the timber so scattering as to look almost as if it had been cleared. The only rule of choice in our swamps is generally the elevation of the ground and its freedom from over-flow. All our swamp land nearly is rich alike—and where free from over-flow, is exceedingly productive. A stiff cane brake of large high cane, is one of the best marks of high land, and those cane prairies are nearly infallible. Look too for those kinds of trees which we have specified as growing only on high land; and avoid trees that have a great inequality between the size, a little above the roots, and the size of the main stem—such as spring from the ground as if they would make a large tree, but fall off at a few feet in height, to perhaps less than half the size of the but. Avoid too, on the other hand, trees which have *no* falling off from their size at the ground—such as appear like immense piles *driven* down into the earth. That appearance is given to them by the settling of the dirt around them, caused by frequent over-flows. The roots of such trees may be many feet below the surface. See that the roots are to be traced plainly on the surface without being covered in this way. Look too to see if the leaves which have fallen annually, have accumulated and lie evenly on the surface, without being washed off or lodged against trees and bushes, by the currents of an over-flow. Avoid such lands as have the appearance of numerous hog-beds—little hills and hollows over the surface. This is occasioned by currents, which in over-flow drift the earth into these inequalities.

We firmly believe, however, that the time is not a century off, when every foot of the immense bottoms of the Mississippi will be redeemed to cultivation, and be found valuable.

MODEL FARMS IN FRANCE.

By Martin Doyle.

(From "A Cyclopædia of Practical Husbandry and Rural Affairs in general.")

There are in France three large model farms, supported chiefly by contributions from individuals, or by the zeal and liberality of a single person, as in the instance of the school at Doville, near Nancy, of which that eminent farmer, M. Dombasle, is the founder and director. Grignon (founded in 1827) is the chief, having 1,100 acres of varied soil in connexion with it. Grignon is one of the royal demesnes, and the present king, anxious to promote the interests of agriculture, gave the buildings and land for forty years to the society which had been formed of many of the nobility and great proprietors, by whom the sum of 600,000 francs was funded as a capital, in shares of 1,200 francs each. The only condition on the part of the crown is, that at the expiration of the term the improvements shall be the property of the crown. At this great seminary there are two classes of pupils, as at Hohenheim. We are informed by John Evelyn Denison, esq., that the best implements from England and Germany are put to trial at Grignon, and that the best systems of husbandry are followed, under the guidance of an able professor; theory and practice going hand in hand.

The internal pupils pay from 30*l.* to 60*l.* a year each, and the external from 8*l.* to 20*l.* Diplomas are granted after a public examination, and the shortest course occupies two years. The same gentleman has informed the public that the three chief veterinary schools at Alfort, Toulouse, and Lyons, afford a course of education which lasts four years. Botany and chemistry, as well as anatomy, are taught in those establishments, in which there are a great number of pupils, who are lodged, boarded, and instructed, for 14*l.* a year; and as it is intended that they should be instructed in the points of useful practice relating to agriculture, in order to be as serviceable as possible in the farming districts, an establishment of bulls and cows, sheep, pigs, and dogs, is kept up, in order to illustrate the diseases of these animals, and invalided horses are taken in at a moderate rate and treated in the hospital.

"The departmental model farms, of which there are several, and many of them insignificant, are differently managed. They are principally supported at the expense of the department in which they are established, after previous approval by the prefect. We have inspected one of these useful and inexpensive schools, near Rennes, and ascertained precisely the details of its establishment and operation. The farm consists of seventy-two acres of arable land, held by lease of fifteen years from a wealthy proprietor, by M. Bodin, who was assisted by the principal authorities of the department of Ile et Vilaine to take the direction of it. M. Bodin had been a pupil at Grignon, and subsequently managed a small farm in a similar capacity, before he obtained the present one, which was in 1837. The rent of the farm, is 3,500 francs (140*l.*), of which the department pays 2,000 francs, and the director the remainder, with taxes and repairs, which amount to about 500 francs more. He also supplies all capital for improvements, and all outgoings, clears all losses, and of course has all the profits.

There are in this school twenty pupils, paying 12*l.* a year each; the department in which the school is situated pays for six, and the government pays for the remaining fourteen, who are nominated by the prefects of three other departments in Brittany. In case of dismissals for misconduct, the prefects nominate other pupils, and they are unwilling to select youths from the towns, or any not accustomed to field labor; they are generally the sons of well-conducted farmers, and

at the expiration of two years go to the aid of their parents, or as hired stewards.

They are taught by M. Bodin, or an assistant, the ordinary subjects suited to their employment, and have no charge except for books, which they must supply for themselves.

M. Bodin has a factory for implements, and disposes of many of them to farmers, even in very distant localities; he is altogether well qualified for his important office, and has obtained a prize for a Treatise on Agriculture, which is now about to be enlarged in a second edition. And when practical men are induced, with moderate assistance, to take the *responsibilities* of a model farm upon themselves, and to receive pupils for three or more years at a reasonable rate of payment, they are the most eligible class of instructers.

INDIAN OR FIELD PEAS.

From the South-Western Farmer.

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In a wet season, one of the greatest difficulties the cotton grower has to contend with in old and rich soils, is the spontaneous and rapid growth of crab grass. This is not only a serious evil to the growing crop, but it extends its malign presence and influence to, and during the picking season; rendering it infinitely more unpleasant and unhealthy to the hands, by the heavy dews it retains, until a late hour of the day. "An ounce of prevention is worth a pound of cure." Now, although I do not know how this *mathematical* axiom was first introduced, or on what data the calculation was made, to arrive at such a rational conclusion, I have as much faith in the assumption, as that "a stitch in time will save nine;" which I *know* to be demonstrable according to "Pike," "Gough," and others of ancient reverence, and if it cannot be proved by those of the present degenerate age, why, I would not give a fig for the whole of them. Now, Messrs., for fear you will be getting tired by such irrelevant matter, I will endeavor to approximate as near as I can to what I *do* want to say.

You must know then that I have great faith in a pea crop, and in my limited experience, I have, I think, arrived at one fact, which by being pursued in the way of rotation, as it should be, I have no doubt will lessen the cotton planter's labor in working his crop at least fifty per cent. Now, it is not my intention to inflict on you and your readers a long article, but if this is well received, no one may know, for the future, what you may have to suffer. I write this article *now*, that *all* may have time to profit by it for the cotton crop of next year.

Do not sow your peas in your corn field—it is a bad plan. Sow them in your rye or oat stubble as soon after you get your crop off the ground as possible—*with at least three pecks to an acre of the greatest running peas, or one bushel or more if of the black or others that run but little.* I prefer sowing them in drills about 2 to 2½ feet apart, dropping two or three peas in a place, when the vines are to be gathered; which should be done before the frost catches them. Sown broadcast when to be fed on the ground, is fully as good a plan. The best method of curing them is to let them get somewhat wilted, not particular how much, so that the leaves are not dried enough to drop off; then throw them into moderate sized cocks in the field, and let them stand until sufficiently cured, which will require several days—even if the weather should be fine—but be not alarmed at rain falling on them. There can be no superior food for stock in any country, and is withal a cheap one. When to be stacked away, the most approved method is to mix alternate layers of dry straw of some description, and a liberal use of salt will not be amiss. This renders the otherwise useless straw, nearly as valuable as the pea fodder, and *ensures the keeping of the latter.*

But this is all digression, I only wanted to say, that I sowed last year in a very grassy piece of ground about three pecks of the "Crowder" peas to the acre, and that this year there is not a spear of crab grass to be seen. They completely matted the ground, and have smothered out every vestige of the grass. No land could have been in finer condition for a cotton crop this spring in consequence. The pea crop was worth to *me* at the rate of at least $20 per acre, estimating corn to be worth 50 cents per bushel. I do not think that the pea is proportionate to the increased quantity of vine, but the hay that can be made from them vastly counterbalances any deficiency in that respect. The objection may be made that no one would want to sow as many peas as would prepare his entire cotton ground; if so, sow all you can. But I wonder if it would not be better to plant less cotton and more peas, and feed and keep well more good cows, horses, mules and oxen. * * * *

MINERAL BONE EARTH.

From the British American Farmer.

Mr. Pusey, M. P., reported to the Council of the Royal English Agricultural Society, as chairman of the geological committee, the result of Professor Phillips' examination of the specimens of native phosphate of lime from Estramadura, in Spain, presented to the society by Mr. Kemberley at a former meeting of the council, and referred to the geological committee for their opinion of its value in an agricultural point of view, as a substitute to a certain extent, and as far as the phosphate of lime was concerned, for bone-dust as a manure.

Mr. Phillips found that this specimen contained no less than 90 per cent. of the phosphate, and he was therefore of opinion that it would be a most important manuring application, provided its mechanical texture could be modified in such manner as to assimilate it to that of the phosphate existing in bone-dust. Mr. Pusey reported that Professor Phillips' investigation on this point had led to a successful result, and that he had discovered a mode by which this valuable mineral substance could be brought into a fit state for application as a manure; but he considered that it would be important that a full examination of this substance should be instituted, previous to any steps being taken to import it as an article of commerce.

Dr. Daubeny is about to undertake a journey

into Spain, at his own expense, for the purpose of inspecting the geological occurrence of this mineral in that country.

GEOMETERS, CANKER-WORMS, PLANT LICE.

(From Harris's Report on the Insects of Massachusetts.)

The caterpillars of the *Geometræ* of Linnæus, earth-measurers, as the term implies, or geometers, span-worms, and loopers, have received these several names from their peculiar manner of moving, in which they seem to measure or span over the ground, step by step, as they proceed. Most of these caterpillars have only ten legs; namely, six, which are jointed and tapering under the fore part of the body, and four fleshy proplegs, at the hinder extremity; the three intermediate pairs of proplegs being wanting. Consequently, in creeping, they arch up the back while they bring forward the hinder part of the body, and then resting on their hind legs, stretch out to their full length, in a straight line, before taking another step with their hind legs. Some of the geometers have twelve or fourteen legs; but the additional proplegs are so short that the caterpillars cannot use them in creeping, and their motions are the same as those that have only ten legs. Some caterpillars with fourteen legs, and wanting only the terminal pair of proplegs, are placed in this tribe on account of the resemblance of their moths, to those of the true geometers. The latter live on trees and bushes, and most of them undergo their transformations upon or in the ground, to reach which, by travelling along the branches and down the stem, would be a long and tedious journey to them, on account of the deficiency of their legs, and the slowness of their gait. But they are not reduced to this necessity; for they have the power of letting themselves down from any height, by means of a silken thread, which they spin from their mouths while falling. Whenever they are disturbed, they make use of this faculty, drop suddenly, and hang suspended, till the danger is past, after which they climb up again by the same thread. In order to do this, the span-worm bends back its head and catches hold of the thread above its head with one of the legs of the third segment, then raising its head it seizes the thread with its jaws and fore legs, and, by repeating the same operations with tolerable rapidity, it soon reaches its former station on the tree. These span-worms are naked, or only thinly covered with very short down; they are mostly smooth, but sometimes have warts or irregular projections on their backs. They change their color usually as they grow older, and sometimes of one uniform color, nearly resembling the bark of the plants on which they are found. When not eating, many of them rest on the two hindmost pairs of legs against the side of a branch, with the body extended from the branch, so that they might be mistaken for a twig of the tree; and in this position they will often remain for hours together. When about to transform, most of these insects descend from the plants on which they live, and either bury themselves in the ground, or conceal themselves on the surface, under a slight covering of leaves fastened together with silken threads. Some make more regular cocoons, which, however, are very thin, and generally more or less covered on the outside with leaves. The cocoons of the European-tailed geometer (*Ourapteryx sambucaria,*) which lives on the elder, and of our chain-dotted geometer (*Geometra catenaria,*) which is found on the wood-wax, are made with regular meshes, like net-work, through which the insects may be seen. A very few of the span-worms fasten themselves to the stems of plants, and are changed to chrysalids, which hang suspended, without the protection of any outer covering.

In their perfected state, these insects are mostly slender-bodied moths, with tapering antennæ, which are often feathered in the males. Their feelers are short and slender; the tongue is short and weak; the thorax is not crested; the wings are large, thin, and delicate—sometimes angular, and often marked with one or two dark-colored oblique bands. They generally rest with the wings slightly inclined and almost horizontal; some with them extended, and others with the hind wings covered by the upper pair. A very few carry their wings like the skippers. Some of the females are without wings, and are distinguished also by the oval and robust form of their bodies. These moths are most active in the night; but some of them may be seen flying in thickets during the day time. They are very short-lived, and die soon after their eggs are laid.

Those kinds whereof the females are wingless, or have only very short, scale-like wings and naked antennæ, while the males have large, entire wings, and feathers or downy antennæ, seem to form a distinct group, which may be named hybernians (*Hyberniadæ,*) from the principal genus included therein. The caterpillars have only ten legs, six before and four behind; and they undergo their transformations in the ground. The insects called canker-worms, in this country, are of this kind. The moths, from which they are produced, belong to the genus *Anisopteryx,* (literally unequal wing,) so named because in some species the wings in the two sexes are very unequal in size, and in others the females are wingless. In the late Professor Peck's "Natural History of the Canker-worm," which was published among the papers of the Massachusetts Society for promoting Agriculture, and obtained a prize from the society, this insect is called *Phalæna vernata,* on account of its common appearance in the spring, and also to distinguish it from the winter moth (*Phalæna* or *Cheimatobia brumata*) of Europe. In the male canker-worm moth the antennæ have a very narrow, and almost downy edging, on each side, hardly to be seen with the naked eye. The feelers are minute, and do not extend beyond the mouth. The tongue is not visible. The wings are large, very thin and silky; and, when the insect is at rest, the fore wings are turned back, entirely cover the hind wings, and overlap on their inner edges. The fore wings are ash-colored, with a distinct whitish spot on the front edge, near the tip; they are crossed by two jagged, whitish bands, along the sides of which there are several blackish dots; the outermost band has an angle near the front edge, within which there is a short, faint, blackish line; and there is a row of black dots along the outer margin, close to the fringe. The hind wings are pale ash-colored, with a faint blackish dot near the middle. The wings expand about

one inch and a quarter. This is the usual appearance of the male, in its most perfect condition; by which it will be seen that it closely resembles the *Anisopteryx æscularia* of Europe. Compared with the latter, I find that our canker-worm moth is rather smaller, the wings are darker, proportionally shorter and more obtuse, the white bands are less distinct, and are often entirely wanting, in which case only the whitish spot near the tip remains, the hind wings are more dusky, and the feelers are gray instead of being white. Specimens, of a rather smaller size, are sometimes found, resembling the figure and description given by Professor Peck, in which the whitish bands and spot are wanting, and there are three interrupted dusky lines across the fore wings, with an oblique blackish dash near the tip. Perhaps they constitute a different species from that of the true canker-worm moth. Should this be the case, the latter may be called *Anisopteryx pometaria*, or the anisopteryx of the orchard, while the former should retain the name originally given to it by Professor Peck. The female is wingless, and its antennæ are short, slender, and naked. Its body approaches to an oval form, but tapers, and is turned up behind. It is dark ash-colored above, and gray beneath.

It was formerly supposed that the canker-worm moths came out of the ground only in the spring. It is now known that many of them rise in the autumn and in the early part of the winter. In mild and open winters I have seen them in every month from October to March. They begin to make their appearance after the first hard frosts in the autumn, usually towards the end of October, and they continue to come forth, in greater or smaller numbers, according to the mildness or severity of the weather after the frosts have begun. Their general time of rising is in the spring, beginning about the middle of March, but sometimes before, and sometimes after this time; and they continue to come forth for the space of about three weeks. It has been observed that there are more females than males among those that appear in the autumn and winter, and that the males are most abundant in the spring. The sluggish females instinctively make their way towards the nearest trees, and creep slowly up their trunks. In a few days afterwards they are followed by the winged and active males, which flutter about and accompany them in their ascent, during which the insects pair. Soon after this, the females lay their eggs upon the branches of the trees, placing them on their ends, close together in rows, forming clusters of from sixty to one hundred eggs or more, which is the number usually laid by each female. The eggs are glued to each other and to the bark, by a grayish varnish, which is impervious to water; and the clusters are thus securely fastened in the forks of the small branches, or close to the young twigs and buds. Immediately after the insects have thus provided for a succession of their kind, they begin to languish, and soon die. The eggs are usually hatched between the first and the middle of May, or about the time that the red currant is in blossom, and the young leaves of the apple tree begin to start from the bud and grow. The little canker-worms, upon making their escape from the eggs, gather upon the tender leaves, and, on the occurrence of cold and wet weather, creep for shelter into the bosom of the bud, or into the flowers, when the latter appear. As this treatise may fall into the hands of persons who are not acquainted with the habits and devastations of our canker-worms, it should be stated that, where these insects prevail, they are most abundant on apple and elm trees; but that cherry, plum, and lime trees, and some other cultivated and native trees, as well as many shrubs, often suffer severely from their voracity. The leaves first attacked will be found pierced with small holes; these become larger and more irregular when the canker-worms increase in size: and, at last, the latter eat nearly all the pulpy parts of the leaves, leaving little more than the midrib and veins. A very great difference of color is observable among canker-worms of different ages, and even among those of the same age and size. It is possible that some of these variations may arise from a difference of species; but it is also true that the same species varies much in color. When very young, they have two minute warts on the top of the last ring; and they are then generally of a blackish or dusky brown color, with a yellowish stripe on each side of the body; there are two whitish bands across the head; and the belly is also whitish. When fully grown, these individuals become ash-colored on the back, and black on the sides, below which the pale yellowish line remains. Some are found of a dull, greenish yellow, and others of a clay color, with slender interrupted blackish lines on the sides, and small spots of the same color on the back. Some are green, with two white stripes on the back. The head and the feet partake of the general color of the body; the belly is paler. When not eating, they remain stretched out at full length, and resting on their fore and hind legs, beneath the leaves. When fully grown and well fed, they measure nearly or quite one inch in length. They leave off eating when about four weeks old,* and begin to quit the trees; some creep down by the trunk, but great numbers let themselves down by their threads from the branches, their instincts prompting them to get to the ground by the most direct and easiest course. When thus descending, and suspended in great numbers under the limbs of trees overhanging the road, they are often swept off by passing carriages, and are thus conveyed to other places. After reaching the ground, they immediately burrow in the earth, to the depth of from two to six inches, unless prevented by weakness or the nature of the soil. In the latter case, they die, or undergo their transformations on the surface. In the former, they make little cavities or cells in the ground, by turning round repeatedly and fastening the loose grains of earth about them with a few silken threads. Within twenty-four hours afterwards, they are changed to chrysalids in their cells. The chrysalis is of a light brown color, and varies in size according to the sex of the insect contained in it; that of the female being the largest, and being destitute of a covering for wings, which is found in the chrysalis of the males. The occurrence of mild weather after a severe frost stimu-

* In the year 1841, the red currant flowered, and the canker-worms appeared, on the 15th of May. The insects were very abundant on the 15th of June, and on the 17th scarcely one was to be seen.

lates some of these insects to burst their chrysalis skins and come forth in the perfected state; and this last transformation, as before stated, may take place in the autumn, or in the course of the winter, as well as in the spring; it is also retarded, in some individuals, for a year or more beyond the usual time. They come out of the ground mostly in the night, when they may be seen struggling through the grass as far as the limbs extend from the body of the trees under which they had been buried. As the females are destitute of wings, they are not able to wander far from the trees upon which they had lived in the caterpillar state. Canker-worms are therefore naturally confined to a very limited space, from which they spread year after year. Accident however, will often carry them far from their native haunts, and in this way probably they have extended to places remote from each other. Where they have become established, and have been neglected, their ravages are often very great. In the early part of the season, the canker-worms do not attract much attention; but it is in June, when they become extremely voracious, that the mischief they have done is rendered apparent, when we have before us the melancholy sight of the foliage of our fruit trees and of our noble elms reduced to withered and lifeless shreds, and whole orchards looking as if they had been suddenly scorched with fire.

In order to protect our trees from the ravages of canker-worms, where these looping spoilers abound, it should be our aim, if possible, to prevent the wingless females from ascending the trees to deposite their eggs. This can be done by the application of tar around the body of the tree, either directly on the bark, as has been the most common practice, or, what is better, over a broad belt of clay mortar, or on strips of old canvass or of strong paper, from six to twelve inches wide, fastened around the trunk with strings. The tar must be applied as early as the first of November, and perhaps in October, and it should be renewed daily as long as the insects continue rising; after which the bands may be removed, and the tar should be entirely scraped from the bark. When all this has been properly and seasonably done, it has proved effectual. The time, labor and expense attending the use of tar, and the injury that it does the trees when allowed to run and remain on the bark, have caused many persons to neglect this method, and some to try various modifications of it, and other expedients. Among the modifications may be mentioned a horizontal and close-fitting collar of boards, fastened around the trunk, and smeared beneath with tar; or four boards, nailed together like a box, without top or bottom, around the base of the tree, to receive the tar on the outside. These can be used to protect a few choice trees in a garden, or around a house or a public square, but will be found too expensive to be applied to any great extent. Collars of tin plate, fastened around the trees, and sloping downwards like an inverted tunnel, have been proposed, upon the supposition that the moths would not be able to creep in an inverted position, beneath the smooth and sloping surface. This method will also prove too expensive for general adoption, even should it be found to answer the purpose. A belt of cotton-wool, which it has been thought would entangle the feet of the insects, and thus keep them from ascending the trees, has not proved an effectual bar to them. Little square or circular troughs of tin or of lead, filled with cheap fish oil, and placed around the trees, three feet or more above the surface of the ground, with a stuffing of cloth, hay, or sea-weed between them and the trunk, have long been used by various persons in Massachusetts with good success; and the only objections to them are the cost of the troughs, the difficulty of fixing and keeping them in their places, and the injury suffered by the trees when the oil is washed or blown out and falls upon the bark. Mr. Jonathan Dennis, jr., of Portsmouth, Rhode Island, has obtained a patent for a circular leaden trough to contain oil, offering some advantages over those that have heretofore been used, although it does not entirely prevent the escape of the oil, and the nails, with which it is secured, are found to be injurious to the trees. These troughs ought not to be nailed to the trees, but should be supported by a few wooden wedges driven between them and the trunks. A stuffing of cloth, cotton or tow, should never be used; sea-weed and fine hay, which will not absorb the oil, are much better. Before the troughs are fastened and filled, the body of the tree should be well coated with clay paint or white wash, to absorb the oil that may fall upon it. Care should be taken to renew the oil as often as it escapes or becomes filled with the insects. These troughs will be found more economical and less troublesome than the application of tar, and may safely be recommended and employed, if proper attention is given to the precautions above named. Some persons fasten similar troughs, to contain oil, around the outer sides of an open box enclosing the base of the tree, and a projecting ledge is nailed on the edge of the box to shed the rain; by this contrivance, all the danger of hurting the tree with the oil is entirely avoided. In the 'Manchester Guardian," an English newspaper, of the 4th of November, 1840, is the following article on the use of melted Indian rubber to prevent insects from climbing up trees:—

"At a late meeting of the Entomological Society, [of London?] Mr. J. H. Fennell communicated the following successful mode of preventing insects ascending the trunks of fruit trees. Let a piece of Indian rubber be burnt over a gallipot, into which it will gradually drop in the condition of a viscid juice, which state, it appears, it will always retain; for Mr. Fennell has, at the present time, some which has been melted for upwards of a year, and has been exposed to all weathers without undergoing the slightest change. Having melted the Indian rubber, let a piece of cord or worsted be smeared with it, and then tied several times round the trunk. The melted substance is so very sticky, that the insects will be prevented, and generally captured, in their attempts to pass over it. About three pennyworth of Indian rubber is sufficient for the protection of twenty ordinary sized fruit trees."

Applied in this way, it would not be sufficient to keep the canker-worm moths from getting up the trees; for the first comers would soon bridge over the cord with their bodies, and thus afford a passage to their followers. To insure success, it should be melted in larger quantities, and daubed with a brush upon strips of cloth or paper, fasten-

ed round the trunks of the trees. Worn out Indian rubber shoes, which are worth little or nothing for any other purpose, can be put to this use. This plan has been tried by a few persons in the vicinity of Boston, some of whom speak favorably of it. It has been suggested that the melted rubber might be applied immediately to the bark without injuring the trees. A little conical mound of sand surrounding the base of the tree is found to be impassable to the moths, so long as the sand remains dry; but they easily pass over it when the sand is wet, and they come out of the ground in wet, as often as in dry weather.

Some attempts have been made to destroy the canker-worms after they were hatched from the eggs, and were dispersed over the leaves of the trees. It is said that some persons have saved their trees from these insects by freely dusting air-slacked lime over them while the leaves were wet with dew. Showering the trees with mixtures that are found useful to destroy other insects has been tried by a few, and although attended with a good deal of trouble and expense, it may be worth our while to apply such remedies upon small and choice trees. Mr. David Haggerston, of Waterton, Ms., has used for this purpose a mixture of water and oil-soap, (an article to be procured from the manufactories where whale oil is purified,) in the proportion of one pound of the soap to seven gallons of water; and he states that this liquor, when thrown on the trees with a garden engine, will destroy the canker-worm and many other insects, without injuring the foliage or the fruit. Jarring or shaking the limbs of the trees will disturb the canker-worms, and cause many of them to spin down, when their threads may be broken off with a pole; and if the troughs around the trees are at the same time replenished with oil, or the tar is again applied, the insects will be caught in their attempts to creep up the trunks. In the same way, also, those that are coming down the trunks to go into the ground will be caught and killed. If greater pains were to be taken to destroy the insects in the caterpillar state, their numbers would soon greatly diminish.

Even after they have left the trees, have gone into the ground, and have changed their forms, they are not wholly beyond the reach of means for destroying them. One person told me that his swine, which he was in the habit of turning into his orchard in the autumn, rooted up and killed great numbers of the chrysalids of the canker-worms. Some persons have recommended digging or ploughing under the trees in autumn, with the hope of crushing some of the chrysalids by so doing, and of exposing others to perish with the cold of the following winter. If hogs are then allowed to go among the trees, and a few grains of corn are scattered on the loosened soil, these animals will eat many of the chrysalids as well as the corn, and will crush others with their feet. Mr. S. P. Fowler* thinks it better to dig round the trees in July, while the shells of the insects are soft and tender. He and Mr. John Kenrick, of Newton, Mass., advise us to remove the soil to the distance of four or five feet from the trunk of the trees, and to the depth of six inches, to cart it away and replace it with an equal quantity of compost or rich earth. In this way, many of the insects will be removed also; but, unless the earth thus carried away, is thrown into some pond hole, and left covered with water, many of the insects contained in it will undergo their transformations, and come out alive the next year.

Canker-worms are subject to the attacks of many enemies. Great numbers of them are devoured by several kinds of birds, which live almost entirely upon them during their season. They are also eaten by a very large and splendid ground-beetle, (*Calosoma scrutator,*) that appears about the time when these insects begin to leave the trees. These beetles do not fly, but they run about in the grass after the canker-worms, and even mount upon the trunks of the trees to seize them as they come down. The latter are also stung by a four-winged ichneumon-fly, which deposites an egg in every canker-worm thus wounded. From the egg is hatched a little maggot, that preys on the fatty substance of the canker-worm, and weakens it so much that it is unable to go through its future transformations. I have seen one of these flies sting several canker-worms in succession, and swarms of them may be observed around the trees as long as the canker-worms remain. Their services, therefore, are doubtless very considerable. Among a large number of canker-worms, taken promiscuously from various trees, I found that nearly one-third of the whole were unable to finish their transformations, because they had been attacked by internal enemies of another kind. These were little maggots, that lived singly within the bodies of the canker-worms, till the latter died from weakness; after which the maggots underwent a change, and finally came out of the bodies of their victims in the form of small two-winged cuckoo-flies, belonging to the genus *Tachina.* Mr. E. C. Herrick, of New Haven, Connecticut, has made the interesting discovery that the eggs of the canker-worm moth are pierced by a tiny four-winged fly, a species of *Platygaster,* which goes from egg to egg, and drops in each of them one of her own eggs. Sometimes every canker-worm egg in a cluster will be found to have been thus punctured and seeded for a future harvest of the *Platygaster.* The young of this *Platygaster* is an exceedingly minute maggot, hatched within the canker-worm egg, the shell of which, though only one thirtieth of an inch long, serves for its habitation, and the contents for its food, till it is fully grown; after which it becomes a chrysalis within the same shell, and in due time comes out a *Platygaster* fly, like its parent. This last transformation Mr. Herrick found to take place towards the end of June, from eggs laid in November of the year before; and he thinks that the flies continue alive through the summer, till the appearance of the canker-worm moths in the autumn affords them the opportunity of laying their eggs for another brood. As these little parasites prevent the hatching of the eggs wherein they are bred, and as they seem to be very abundant, they must be of great use in preventing the increase of the canker-worm. Without doubt such wisely appointed means as these were once enough to keep within due bounds these noxious insects; but since our forests, their natural food, and our birds, their greatest enemies, have disappeared before

* See Yankee Farmer, of July 18, 1840, and New England Farmer, of June 2, 1841, for some valuable remarks by Mr. Fowler.

the woodman's axe and the sportsman's gun, we are left to our own ingenuity, perseverance, and united efforts, to contrive and carry into effect other means for checking their ravages.

Apple, elm, and lime trees are sometimes injured a good deal by another kind of span-worm, larger than the canker-worm. As they resemble the latter in their habits, and often live on the same trees, they can be kept in check by such means as are found useful when employed against canker-worms.

PLANT LICE.

Aphides, or plant-lice, as they are usually called, are among the most extraordinary of insects. They are found upon almost all parts of plants, the roots, stems, young shoots, buds, and leaves, and there is scarcely a plant which does not harbor one or two kinds peculiar to itself. They are, moreover, exceedingly prolific, for Reaumur has proved that one individual, in five generations, may become the progenitor of nearly six thousand millions of descendants. It often happens that the succulent extremities and stems of plants will, in an incredibly short space of time, become completely coated with a living mass of these little lice. These are usually wingless, consisting of the young and of the females only; for winged individuals appear only at particular seasons, usually in the autumn, but sometimes in the spring, and these are small males and larger females. After pairing, the latter lay their eggs upon or near the leaf-buds of the plant upon which they live, and, together with the males, soon afterwards perish.

The genus to which plant-lice belong is called *Aphis*, from a Greek word which signifies to exhaust. The following are the principal characters by which they may be distinguished from other insects. Their bodies are short, oval, and soft, and are furnished at the hinder extremity with two little tubes, knobs, or pores, from which exude almost constantly minute drops of a fluid as sweet as honey; their heads are small, their beaks are very long and tubular, their eyes are globular, but they have not eyelets, their antennæ are long, and usually taper towards the extremity, and their legs are also long and very slender, and there are only two joints to their feet. Their upper are nearly twice as large as the lower wings, are much longer than the body, are gradually widened towards the extremity, and nearly triangular; they are almost vertical when at rest, and cover the body above like a very sharp-ridged roof.

The winged plant-lice provide for a succession of their race by stocking the plants with eggs in the autumn, as before stated. These are hatched in due time in the spring, and the young lice immediately begin to pump up sap from the tender leaves and shoots, increase rapidly in size, and in a short time come to maturity. In this state, it is found that the brood, without a single exception, consists wholly of females, which are wingless, but are in a condition immediately to continue their kind. Their young, however, are not hatched from eggs, but are produced alive, and each female may be the mother of fifteen or twenty young lice in the course of a single day. The plant-lice of this second generation are also wingless females, which grow up and have their young in due time; and thus brood after brood is produced, even to the seventh generation or more, without the appearance or intervention, throughout the whole season, of a single male. This extraordinary kind of propagation ends in the autumn with the birth of a brood of males and females, which in due time acquire wings and pair; eggs are then laid by these females, and with the death of these winged individuals, which soon follows, the race becomes extinct for the season.

Plant lice seem to love society, and often herd together in dense masses, each one remaining fixed to the plant by means of its long tubular beak; and they rarely change their places till they have exhausted the part first attacked. The attitudes and manners of these little creatures are exceedingly amusing. When disturbed, like restive horses they begin to kick and sprawl in the most ludicrous manner. They may be seen at times suspended by their beak alone, and throwing up their legs as if in a high frolic, but too much engaged in sucking to withdraw their beaks. As they take in great quantities of sap, they would soon become gorged if they did not get rid of the superabundant fluid through the two little tubes or pores at the extremity of their bodies. When one of them gets running-over full, it seems to communicate its uneasy sensations, by a kind of animal magnetism, to the whole flock, upon which they all, with one accord, jerk upwards their bodies, and eject a shower of the honeyed fluid.

The leaves and bark of plants much infested by these insects are often completely sprinkled over with drops of this sticky fluid, which on drying becomes dark-colored, and greatly disfigures the foliage. This appearance has been denominated honey-dew; but there is another somewhat similar production observable on plants, after very dry weather, which has received the same name, and consists of an extravasation or oozing of the sap from the leaves. We are often apprized of the presence of plant-lice on plants growing in the open air, by the ants ascending and descending the stems. By observing the motions of the latter, we soon ascertain that the sweet fluid discharged by the lice is the occasion of these visits. The stems swarm with slim and hungry ants, running upwards, and others lazily descending, with their bellies swelled almost to bursting. When arrived in the immediate vicinity of the plant-lice, they greedily wipe up the sweet fluid which has distilled from them, and, when this fails, they station themselves among the lice, and catch the drops as they fall. The lice do not seem in the least annoyed by the ants, but live on the best possible terms with them; and, on the other hand, the ants, though unsparing of other insects weaker than themselves, upon which they frequently prey, treat the plant-lice with the utmost gentleness, caressing them with their antennæ, and apparently inviting them to give out the fluid by patting their sides. Nor are the lice inattentive to these solicitations, when in a state to gratify the ants, for whose sake they not only seem to shorten the periods of the discharge, but actually yield the fluid when thus pressed. A single louse has been known to give it drop by drop successively to a number of ants, that were waiting anxiously to receive it. When the plant-lice cast their skins, the ants instantly remove the latter, nor will they allow any dirt or rubbish to remain

upon or about them. They even protect them from their enemies, and run about them in the hot sunshine to drive away the little ichneumon flies that are for ever hovering near to deposite their eggs in the bodies of the lice.

Plant-lice differ very much in form, color, clothing, and in the length of the honey-tubes. Some have these tubes quite long, as the rose-louse, *Aphis rosæ*, which is green, and has a little conical projection or stylet, as it is called, at the extremity of the body, between the two honey-tubes. The cabbage-louse, *Aphis brassicæ*, has also long honey-tubes, but its body is covered with a whitish mealy substance. This species is very abundant on the under side of cabbage leaves in the month of August. The largest species known to me is found in clusters beneath the limbs of the pig nut hickory (*Carya porcina*,) in all stages of growth, from the 1st to the middle of July. It is the *Aphis caryæ* of my Catalogue. Its body, in the winged state, measures one quarter of an inch to the end of the abdomen, and above four-tenths of an inch to the tips of the upper wings, which expand rather more than seven-tenths of an inch. It has no terminal stylet, and the honey-tubes are very short. Its body is covered with a bluish-white substance, like the bloom of a plum, with four rows of little transverse black spots on the back; the top of the thorax, and the veins of the wings are black, as are also the shanks, the feet, and the antennæ, which are clothed with black hairs; the thighs are reddish-brown. This species sucks the sap from the limbs and not from the leaves of the hickory. There is another large species, living in the same way on the under side of the branches of various kinds of willows, and clustered together in great numbers. About the first of October they are found in the winged state. The body is one-tenth of an inch in length, and the wings expand about four-tenths. The stylet is wanting; the body is black and without spots; the wings are transparent, but their veins, the short honey tubercles, the third joint of the antennæ, and the legs are tawny yellow. This species cannot be identical with the willow-louse, *Aphis salicis* of Linnæus, which has a spotted body; and therefore I propose to call it *Aphis salicti*, the plant-louse of willow groves. When crushed, it communicates a stain of a reddish or deep orange color.

Some plant-lice live in the ground and derive their nourishment from the roots of plants. We annually lose many of our herbaceous plants, if cultivated in a light soil, from the exhausting attacks of these subterranean lice. Upon pulling up China asters, which seemed to be perishing from no visible cause, I have found hundreds of little lice, of a white color, closely clustered together on the roots. I could never discover any of them that were winged, and therefore conclude from this circumstance, as well as from their peculiar situation, that they never acquire wings. Whether these are of the same species as the *Aphis radicum* of Europe, I cannot ascertain, as no sufficient description of the latter has ever come to my notice. These little lice are attended by ants, which generally make their nests near the roots of the plants, so as to have their milch kine, as the plant-lice have been called, within their own habitations: and in consequence of the combined operations of the lice and the ants, the plants wither and prematurely perish. When these subterranean lice are disturbed, the attendant ants are thrown into the greatest confusion and alarm; they carefully take up the lice which have fallen from the roots, and convey them in their jaws into the deep recesses of their nests; and here the lice still contrive to live upon the fragments of the roots left in the soil. It is stated in Kirby and Spence's Introduction to Entomology, that the ants bestow the same care and attention upon the root-lice as upon their own offspring—that they defend them from the attacks of other insects, and carry them about in their mouths to change their pasture; and that they pay particular attention to the eggs of the lice, frequently moistening them with their tongues, and in fine weather bringing them to the surface of the nest, to give them the advantage of the sun. On the other hand, the sweet fluid supplied in abundance by these lice forms the chief nutriment both of the ants and their young, which is sufficient to account for their solicitude and care for their valuable herds.

The peach tree suffers very much from the attacks of plant-lice, which live under the leaves, causing them by their punctures to become thickened, to curl or form hollows beneath, and corresponding crispy and reddish swellings above, and finally to perish and drop off prematurely. Whether our insect is the same as the European aphis of the peach tree (*Aphis Persicæ* of Sulzer,) I cannot determine, for the want of a proper description of the latter. The depredations of these lice is one of the causes, if not the only cause, of the peculiar malady affecting the peach tree in the early part of summer, and called the blight.

The injuries occasioned by plant-lice are much greater than would at first be expected from the small size and extreme weakness of the insects; but these make up by their numbers what they want in strength individually, and thus become formidable enemies to vegetation. By their punctures, and the quantity of sap which they draw from the leaves, the functions of these important organs are deranged or interrupted, the food of the plant, which is there elaborated to nourish the stem and mature the fruit, is withdrawn, before it can reach its proper destination, or is contaminated and left in a state unfitted to supply the wants of vegetation.

Plants are differently affected by these insects. Some wither and cease to grow, their leaves and stems put on a sickly appearance, and soon die from exhaustion. Others, though not killed, are greatly impeded in their growth, and their tender parts, which are attacked, become stunted, curled, or warped.

The punctures of these lice seem to poison some plants, and affect others in a most singular manner, producing warts or swellings, which are sometimes solid and sometimes hollow, and contain in their interior a swarm of lice, the descendants of a single individual, whose punctures were the original cause of the tumor. I have seen reddish tumors of this kind, as big as a pigeon's egg, growing upon leaves, to which they were attached by a slender neck, and containing thousands of small lice in their interior. Naturalists call these tumors galls, because they seem to be formed in the same way as the oak galls which

are used in the making of ink. The lice which inhabit or produce them, generally differ from the others, in having shorter antennæ, being without honey-tubes, and in frequently being clothed with a kind of white down, which, however, disappears when the insects become winged.

These downy plant-lice are now placed in the genus *Eriosoma*, which means woolly body, and the most destructive species belonging to it was first described under the name of *Aphis lanigera*, by Mr Hausmann, in the year 1801, as infesting the apple trees in Germany. It seems that it had been noticed in England as early as the year 1787, and has since acquired there the name of American blight, from the erroneous supposition that it had been imported from this country. It was known, however, to the French gardeners for a long time previous to both of the above dates, and, according to Mr Renie, is found in the orchards, about Harfleur, in Normandy, and is very destructive to the apple trees in the department of Calvados. There is now good reason to believe that the miscalled American blight is not indigenous to this country, and that it has been introduced here with fruit trees from Europe. Some persons, indeed, have supposed that it was not to be found in this country, at all, but the late Mr Buel has stated that it existed on his apple trees, and I have once or twice seen it on apple trees in Massachusetts, where, however, it stills appears to he rare, and consequently I have not been able to examine the insects sufficiently myself. The best account that I have seen of them is contained in Knapp's Journal of a Naturalist," from which, and from Hausmann's description, the following observations are chiefly extracted.

The eggs of the woolly apple tree louse are so small as not to be distinguished without a microscope, and are enveloped in a cotton-like substance furnished by the body of the insect. They are deposited in the crotches of the branches and in the chinks of the bark at or near the surface of the ground, especially if there are suckers springing from the same place. The young, when first hatched, are covered with a very short and fine down, and appear in the spring of the year like little specks of mould on the trees. As the season advances, and the insect increases in size, its downy coat becomes more distinct, and grows in length daily. This down is very easily removed, adheres to the fingers when it is touched, and seems to issue from all the pores of the skin of the abdomen. When fully grown, the insects of the first brood are one tenth of an inch in length, and when the down is rubbed off, the head, antennæ, sucker, and shins are found to be of a blackish color, and the abdomen honey-yellow. The young are produced alive during the summer, are buried in masses of the down, and derive their nourishment from the sap of the bark and of the alburnum or young wood immediately under the bark. The adult insects never acquire wings, at least such is the testimony both of Hausmann and Knapp, and are destitute of honey-tubes, but from time to time emit drops of a sticky fluid from the extremity of the body. These insects, though destitute of wings, are conveyed from tree to tree by means of their long down, which is so plentiful and so light as easily to be wafted by the winds of autumn, and thus the evil will gradually spread throughout an extensive orchard. The numerous punctures of these lice produce on the tender shoots a cellular appearance, and wherever a colony of them is established, warts or excresences arise on the bark; the limbs thus attacked become sickly, the leaves turn yellow and drop off; and, as the infection spreads from limb to limb, the whole tree becomes diseased, and eventually perishes. In Gloucestershire, England, so many apple trees were destroyed by these lice in the year 1810, that it was feared the making of cider must be abandoned. In the north of England the apple trees are greatly injured, and some annually destroyed by them, and in the year 1826, they abounded there in such incredible luxuriance, that many trees seemed, at a short distance, as if they had been whitewashed.

Mr. Knapp thinks that remedies can prove efficacious in removing this evil only upon a small scale, and that when the injury has existed for some time, and extended its influence over the parts of a large tree, it will take its course, and the tree will die. He says that he has removed this blight from young trees, and from recently attacked places in those more advanced, by painting over every node or infected part of the tree with a composition consisting of three ounces of melted resin mixed with the same quantity of fish oil, which is to be put on while warm, with a painter's brush.

Sir Joseph Banks succeeded in extirpating the insects from his own trees by removing all the old and rugged bark, and scrubbing the trunk and branches with a hard brush. The application of the spirits of tar, of spirits of turpentine, of oil, urine, and of soft soap, has been recommended. Mr Buel found that oil sufficed to drive the insects from the trunks and branches, but that it could not be applied to the roots, where he stated numbers of the insects harbored.

The following treatment I am inclined to think will prove as successful as any which has heretofore been recommended. Scrape off all the rough bark of the infected trees and make them perfectly clean and smooth early in the spring; then rub the trunk and limbs with a stiff brush wet with a solution of potash, as hereafter recommended for the destruction of bark lice; after which remove the sods and earth around the bottom of the trunk, and with the scraper, brush and alkaline liquor, cleanse that part as far as the roots can conveniently be uncovered. The earth and sods should immediately be carried away, fresh loam should be placed around the roots, and all cracks and wounds should be filled with grafting cement or clay mortar. Small limbs and extremities of branches, if infected, and beyond reach of the applications, should be cut off and burned.

There are several other species of *Eriosoma* or downy lice in this state, inhabiting various forest and ornamental trees, some of which may also have been introduced from abroad. The descriptions of foreign plant-lice are mostly so brief and imperfect that it is impossible to ascertain from them which of our species are identical with those of Europe; I shall therefore omit any further account of these insects, and close this part of the subject with a few remarks on the remedies to be employed for their destruction generally, and some notice of the natural enemies of plant-lice.

Solutions of soap, or a mixture of soap-suds and tobacco-water, used warm, and applied with a watering pot or with a garden engine, may be em-

ployed for the destruction of these insects. It is said that hot water may also be employed for the same purpose with safety and success. The water, tobacco-tea, or suds, should be thrown upon the plants with considerable force, and if they are of the cabbage or lettuce kind, or other plants whose leaves are to be used as food, they should subsequently be drenched thoroughly with pure water. Lice on the extremities of branches may be killed by bending over the branches and holding them for several minutes in warm and strong soap-suds. Lice multiply much faster, and are more injurious to plants, in a dry than in a wet atmosphere; hence in green houses, attention should be paid to keep the air sufficiently moist, and the lice are readily killed by fumigations with tobacco or with sulphur. To destroy subterranean lice on the roots of plants I have found that watering with salt water was useful, if the plants were hardy; but tender, herbaceous plants cannot be treated in this way, but may sometimes be revived, when suffering from these hidden foes, by free and frequent watering with soap-suds.

NOVEL MODE OF CULTIVATING CORN.

Extract from the Louisville Journal.

My universal rule is, to plough my corn land the fall preceding the spring when I plant; and as early in the spring as possible, I cross-plough as deep as circumstances will permit, and as soon as this is done, I commence checking off the first way with my large ploughs, and the second with my small ones, the checks, three feet by three, admitting of working the land both ways. And then I plant my corn from the 20th to the 25th of March—a rule to which I adhere with scrupulous exactness; planting from eight to twelve grains in each hill, covering the same *from four to six inches deep*, greatly preferring the latter depth; and in this particular I take more pride and more pains than any other farmer in Kentucky, holding it as my ruling principle, that the product of the corn crop depends very much upon its being properly covered, and much on its being properly ploughed the first time. So soon as my corn crop is up of sufficient height, I start the large harrow directly over the rows, allowing a horse to walk each side, harrowing the way the corn was planted; and on land prepared as above and harrowed as directed, the hoeing part will be so completely performed by this process, that it will satisfy the most skeptical. Then, allowing the corn thus harrowed to remain a few days, I start my small ploughs with the bar next the corn; and so nicely will this be done, that when a row is thus ploughed, so completely will the intermediate spaces, hills, &c., be lapped in by the loose earth occasioned by this system of close ploughing, as to render any other work useless for a time. I thin to four stalks upon a hill, never having to transplant, the second ploughing being performed with the mouldboard towards the rows of corn; and so rapid has been the growth of the corn between the first and second ploughings, that this is performed with ease; and when in this stage, I consider my crop safe; my general rule being, never to plough my corn more than four times, and harrow once. My practice is, to put a field in corn two successive years, then grass it, and let it lie eight years, a rule from which I never deviate. Now, I do not pretend that the labor bestowed upon a sod-field, to put it in a state of thorough cultivation, does not meet with a fair equivalent from one crop, but I presume no farmer will doubt when I say, the second year's crop from sod-land is better than the first, with not more than one half the labor. The best system of farming is, to produce the greatest amount of profit from the smallest amount of labor.

I lay it down as an axiom incontrovertible in the cultivation of corn, that whenever a large crop has been raised, it was the result of close and early planting; and I defy proof to the contrary. I plant my corn three feet by three, four stalks in a hill, and allow but one ear to a stalk, and one hundred ears to a bushel, and then ascertain how many hills there are in a shock, sixteen hills square, which is the usual custom to put it up. My present crop, planted on the 20th of March, bids fair to outstrip any preceding one; I am now ploughing and thinning the first planting.

WALTER C. YOUNG.

Jessamine co., Ky., April 26, 1842.

MANURES.

According to Liebig, the evacuations of an adult, liquid and solid, will annually yield 547 lbs. or one and a half pound per day. This is sufficient to manure fully one acre of wheat or other grain. But even in the modes of preserving and using it by the aid of lime, much of its ammonia is wasted; and it has been shown, that to the ammonia the wheat owes its nitrogen, the element on which we have most to depend for improvement, both in quality and quantity. Lime should no more be mixed with night soil, than with gas liquor; on the contrary, the matters added to absorb the liquid, should have an acid tendency. Gypsum does very well by double decomposition. Peat earth is acidulous enough to fix the ammonia, where at hand; but in large towns, this earth often requires pretty distant carriage. Refuse bark is, however, generally produced in populous places, and is an incumbrance to the tanner, from which he is obliged to contrive various methods for relieving himself; amongst the rest burning, to the great annoyance and suffering of the neighborhood.

But tanners' refuse bark has also enough acidulous quality to fix the ammonia in night soil; and being so generally at hand in populous towns, may be employed for the purpose extensively.

Three parts of tanners' bark to one of night-soil (urine included, which is as valuable as any part,) will make a stronger manure than stable-dung; and with this further advantage, that the stable-dung requires to be rotted, to reduce the long straws, and kill the undigested seeds it contains; whilst the bark being already short, and the night-soil containing no seeds, it may be carted to the field at once; thus saving the heavy waste in rotting.

In the tan-yard, the bark may be stercorized, by having a privy or two, and suitable corners for the work people, all made to drain upon the

heap; calculating say one pound of evacuations liquid and solid from each individual per day, and proportioning the bark to it; what is above that quantity being disposed of to other persons, for the same purpose. All the hide wool and glue washings and house drainings should run into the same, which should be roofed over to keep off the rain, but with open sides to encourage evaporation of the moisture. All the ashes of fires, whether of the works or house, should be added, to help the absorption, and destroy the smell; and by this means, a tanner employing twenty-five hands, may turn out twenty-five pounds evacuations; add three times the quantity of tanners' bark seventy-five pounds; add for ashes, &c., above detailed, and we have one hundred and fifty pounds of manure per day, richer than stable dung, much better for wheat, and losing nothing in rotting as not required. In other places, as private gardens, school grounds, &c., the bark may be procured from the tanner, and added to the privy sink, in rather larger proportions, reckoning the evacuations as one and a half pounds per entire day of twenty-four hours. Much less bark will do, say half as much as the night-soil, making up the quantity with garden mould; but the bark is so much additional vegetable matter, at little cost. It may be thrown in, a load at a time, for the excrement to fall upon; but the ashes should be added daily, so as to lie on the top, and absorb the smell. A long and large trunk should rise from the sink, to encourage evaporation and carry up, also, the smell still remaining; for although much subdued by ashes, it cannot be altogether destroyed, without careful mixture, not practicable for such a purpose. In this manner large quantities may be collected.

Peat earth will do instead of bark, as above stated, with the precaution not to throw it in cohesive lumps, which will not absorb, but as dry and crumbly as possible. The ashes are equally useful in either case.—*Eng. paper.*

EXTRACTS FROM PROCEEDINGS OF THE SOUTH WILTS AND WARMINSTER (ENG.) FARMERS' CLUB.

From the London Farmers' Magazine, for June, 1842.

The first subject for discussion was "on drills."

An intelligent member, who brought this forward, said he had drilled for many years, and had derived much benefit from such a practice; that he had used the horse-hoe with much success on his farm, principally a light soil, in the spring—which was an efficient and economical means of cleaning it: and that, in his opinion, there was a saving of seed in pursuing such a system—in wheat of at least half a bushel per acre, and in barley of as much as two bushels. With regard to the produce, he had generally grown more in grain when drilled than when sown broadcast, although a smaller proportion of seed was used; the *straw*, however, he admitted, was generally deficient. The same system applied equally to turnips, vetches, &c. Many members present seemed to concur in this practice as a desirable one; but some dissented from it, arguing that the broadcast principle produced as much corn, at less expense; and that although it frequently occurred that more grain was sown than when the drill was used it was not necessary; and that an equal quantity of seed would yield quite as favourable a result. Much discussion arose as to which was the best as well as the most economical system to pursue, the drilled or broadcast; but the members present not having made correct calculations on the point, no resolution was agreed on, reserving the subject for a future meeting.

Second subject.—"The diseases of sheep, particularly giddiness."

The member who introduced this subject said, he was anxious to obtain information, rather than offer it, as to the cause and cure of giddiness in sheep; the disease being one of much aggravation to the farmer, who frequently suffered much pecuniary loss by not knowing how to treat it efficaciously. A gentleman of the medical profession being present, was called on for some explanation—and stated he knew but little of the diseases of animals, but thought there was a much greater resemblance between them and the diseases of the human subject than was generally supposed. He believed the disease in question was similar in its character and consequences to that known as water on the brain in the human species; like that, he understood, it more frequently attacked *young subjects*. He was not surprised to hear that the cases were almost universally fatal, as from the nature of the disease he should expect that to be the case. It was doubtless inflammatory affection of the brain, or its membranes, speedily terminating in an effusion of fluid. Even in young children, though watched as they are by their mothers, it but too commonly escaped early notice, and when the disease was once established, he regretted to say, any treatment availed but little. In cases of giddy sheep, he had known the trephine used, and the effused fluid evacuated; but had never heard of a case terminating in recovery. This is just what he should expect, as the delicate structure of the brain was too much disorganized by the disease to admit of its being restored to a healthy state. He feared he could give them but little hope of their arriving at any satisfactory treatment; indeed, unless the disease was detected in the early inflammatory stage, before effusion had taken place, when copious bleeding might avail, he really thought there was nothing to be done. As to a prevention of the disease, this he thought would be best done by keeping the animal in the best state of general health possible, but even with that many cases must occur. He thought breeding in-and-in likely to increase the number of cases, as tending to produce degenerate stock.

Many members present felt the subject in question to be one of great importance, but were not enabled, from their experience, to adopt any satisfactory resolution relative to it.

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"*Paring and burning*" was brought forward by one of the largest farmers and most intelligent members of the society; he stated his opinion that nearly all soils were capable of it, with the exception of sands, and described the fertilizing properties of ashes; recommending that turf should be always removed where plantations were made, and the converting such turf into ashes instead of allowing it to rot; his calculation was,

that one acre of turf, burnt into ashes, was worth quite 30*l.*, after all expenses of labor, &c., and suggested as a proper quantity 250 bushels per acre, mixing with it about two quarters of bone-dust. This mixture was more desirable than using either separately, as the ashes tended materially to force the plant in its early stage, rendering it less liable to the ravages of the fly; whilst the bone-dust told more commonly in ripening the plant and bringing it to perfection. Other members spoke in confirmation, and the following resolution was agreed on: Resolved—"That paring and burning is more beneficial than ploughing and rotting; but the subsequent cultivation should be on the alternate system, the first crop being in most cases a green crop. That the land should be pared as thinly as possible, and if so it does not reduce the quantity of the soil, is preventive of the wire-worm, and may be repeated with advantage as often as a new rug is produced."

ON THE ABOLITION OF THE FIXED BRIDLE OR BEARING REIN.*

From the London Farmers' Magazine, for June, 1842.

There is much mismanagement and consequent misery inflicted on horses through the force and continuance of custom, habit, and prejudice; particularly evinced by the use of the bearing-rein.

The editor is impelled by a wish to do good, promoted by attachment to the horse, and compassion for that much abused and most cruelly-treated animal; influenced too, as he hopes, by a sincere desire to serve and benefit the owners. It is his object, by what he trusts will be found sound reasoning, to bring into disrepute, and (as soon as may be) into disuse, that tormenting part of the harness, the fixed bridle or bearing-rein.

It is a principle in mechanics, that whenever agent or instrument suffers the least resistance from restraint, friction, or other wear or tear, it will do its office with the most care, with the greatest economy of time, and with the least expenditure of strength or money; and this whether the agent or instrument be an animal, or a machine. Hence, to ensure the full exercise of an animal's power in the safest and most easy way to itself, we should be careful not permanently to disturb its natural posture. The question to be decided is, whether or not it is most judicious and proper to give a horse the free use of his head, or to prevent him from having that use.

It must be admited that whenever a horse trips or stumbles, nature prompts him to try to save himself, and he instantly extends his neck and head for the purpose as a man would his arms: this natural effort increases the animal's danger if his head be at all confined by the bearing-rein, because the tug which he gives with his mouth is communicated to the harness upon his back to which the rein is hooked, and the effect is the same as if a man were with both his hands to lay hold of the collar of his coat to save himself. To render the bearing-rein or bridle of any utility in saving an animal from falling, it should be of great strength and substance, and fastened behind and above, or it will be useless.

The dorsal muscles or sinews of the back in all quadrupeds run longitudinally or horizontally from the head and tail, and those extremities are main working powers—what the arms are to a walker or laborer, the head and tail are to the animal; tie a man's arms to his side, and even a gentle push or trip will throw him down. This is the effect produced by the bearing rein. The horse's head being fixed, he is unable to use it as nature intended, and therefore if he trips or slides his head is of no use. When horses stumble, they often break the bearing-rein, and thus getting the head free, are enabled to save themselves. We all know that when a horse is down, the first thing done is to "give him his head" that he may get up. We do not mean to say that a horse will never stumble if worked without a bearing rein, because we know that they sometimes fall whilst loose in the field; but we assert, without fear of contradiction, that the surest way to keep a horse on his legs is at all times to give him the free use of his head. The more he is crippled, the more he needs his head. The bearing-rein may probably be of some use in "breaking* a colt," and may, perhaps, help to "get up his head" until he has been "taught his paces," but afterwards it can answer no end, except *souring his temper, making him jib, deadening his mouth, wasting his strength, hurting his wind, injuring his sight, lessening his speed, abridging his services, shortening his days, throwing him down, and breaking his knees*: all these, it is fearlessly asserted, proceed daily from the use of this cruel appendage.

When running loose, the horse's neck is usually extended as straight as his back; in this manner horses would generally work. It is the natural position, and the nearer we approach to it the better for the animal, for he is then at ease; and (though little remembered) his pulmonary action, or breathing unimpeded. It is absurd to make a bend or an angle, (if at all acute or sharp) in a water-pipe, or hose; so it is absurd and cruel too to bend back out of its natural line the windpipe of the horse by the use of the bearing-rein. In the former case a full volume of water cannot be obtained; in the latter the free breathing of the animal (so essential to its comfort, and even to its life) is hindered.† *Denied* this may be; *disproved* it cannot. The effect of restraining a horse by the bearing-rein, is to prevent him from getting up to the collar. If the bit is in the least degree affected by the bearing-rein; in other words, if it is not entirely loose in the mouth, the horse is checked, and besides being kept from the full free exercise of his strength, he is prevented from leaning the weight of his body into the collar.

We are aware that many who admit that bearing reins are not safe, use them because *they like to see a horse look well, like to see him hold his head up, &c.*; but a kind and humane man would

* Observations on the effect of the fixed bridle, or bearing-rein, and a few words for the English post-horse.—Thomas, Plymouth.

* It would be well if there were more colt benders—the tempers of horses are not studied by the generality of colt breakers; horses' tempers vary as much as men's.

† It is the opinion of many eminent veterinary surgeons, that "roaring and blindness are produced in carriage-horses, and wagon-horses, by the bearing-reins.

not have such foolish desires; the care and comfort of his horse would be his only object. The mischievous effects before stated are often *overlooked* by many to whom the use of the bearing-rein is as natural as the saddle or any part of the harness. The editor has often found very kind and respectable men, wholly ignorant of the pain and agony which their horses have endured.

There is one infallible proof constantly to be obtained of the cruelty of the use of the bearing-rein, and of its injurious effects, though we believe very few persons are aware of it. Whenever a horse has been worked with a tight bearing-rein, the corners of his mouth become *raw, inflame, fester, and eventually the mouth becomes enlarged on each side*; in some cases to the extent of *two inches*. Even before the bit has produced these visible effects, if the corner of the mouth, under the bit, be touched, the animal will flinch as if from hot iron. Let this be the sign with every master and servant.

To what are these enlargements attributable? what causes them? Nothing but the friction of the bit in the efforts of the horse to get up to his work. How dreadful to see a horse heavily laden—his neck bent into a perfect curve—his mouth open—his eyes ready to start out of their sockets. The ignorant, though perhaps not cruelly disposed driver, looks on with admiration to see how "handsome" his horse appears, and imagines that the tossing head, open mouth, and gnashing teeth are signs of game and strength, whilst on the contrary, they are the most unequivocal evidence of distress and agony. Let any one test the truth of this by loosing the bearing-rein, and he will immediately find the horse go faster, keep his mouth shut, and his head in one steady horizontal position.* A short time since the editor stopped a wagon to look at the mouth of the shaft horse—he found the mouth actually cut open by the bit at least two inches on each side: the wagoner said "he know'd it sure, *'twas the fair wear of the ir'n!*" The man was open to conviction, and upon the cause of this dreadful punishment being shown he altered the rein.

The propensity to jib, if not actually caused, is much increased by the bearing-rein. In ascending a hill the freest horse may be compelled to stop and refuse to exert himself, knowing that he can put no more strength till the head is loose. A short time since, in Southampton-street, Covent Garden, the editor of this pamphlet saw a crowd collected looking at a scavenger's cart, fully loaded, drawn by an immense horse. The street is a moderate ascent, and the horse had stopped just below the top of the hill: the driver turned the horse round down the hill, then up, and with his help-mate very humanely assisted by pushing. The horse, without being flogged or spoken to, went on steadily with his very heavy load to about the place he before stopped at, and again "gave up:" he was sweating much, and appeared to be a game good horse. The editor went up to the driver and advised him to unhook the bearing-rein; the man said, "it's nau use, I have turned him around three times"—the editor said, "he must be a good horse to take to the load three times," and pressed him to unhook the rein; the man replied, "the ause 'ill fall down." The editor coaxed him to try, the rein was unhooked, and immediately the horse took the load from the spot where he stood: the man said, "he never saud it done afore." It is not uncommon for considerate drivers to unbear their horses at the foot of a hill, which is a very strong proof of the folly of using the rein at all. It has been and may again be advanced as a plea for its retention, that a horse after having been used to the rein will miss it, and so be liable to fall if he trips after it is taken off. A trial will prove that this is not the result.

It is a common opinion that when a horse trips or stumbles, it is the rider or driver who pulls him up, by the sudden jerk or shortening of his reins, and prevents an actual fall; hence the moment a horse takes a false step, the rider or driver tugs the rein with all his might. We frequently hear it said, "the horse was going to fall, but I pulled him up! I kept him on his legs!" As well might a fly resting on a coach-wheel boast of its kicking up a dust; as well might a wagoner seated on the shafts, think to pull up a wagon which had lost its fore wheel. Such expressions are proofs of the ignorance of those who make them, because when they become aware of the fact that the horse has stumbled, the danger is over—the animal has recovered itself, and their tug is useless. To help an animal effectually there must be "where* to stand on," and both an arm and a rein strong enough. A bearing-rein is fixed to the falling horse and falls with him—it cannot save him; it keeps a horse from seeing and avoiding stones and other impediments, it is a hindrance not a help; an injury, and not a benefit. If he fall with a bearing-rein he must break his knees or the rein, or its hook, or the crupper; if he trips without one, and the driver "gives him his head," by instantly slackening the reins (what few inexperienced Englishmen will either do, or believe to be judicious) the creature is set at liberty, and will probably quickly recover himself, unless receiving, as he is almost sure to do, many heavy lashes. It cannot be supposed that a horse stumbles willingly, therefore to punish him for it is unjust, and only adds to his fear.

It must not, however, be inferred that all who use the bearing-rein approve of it. Servants, when men of humanity, experience, skill, and character, are often found to admit its folly and uselessness, but dare not lay it aside.

It is said that the ladies powerfully obstruct the removal of this useless and injurious instrument. It is hoped that the few who drive and the many who keep their own horses, will give the best and strongest denial to this scandalous imputation, by immediately reprobating the use of the rein. Could their poor horses answer the questions—Why do you continually toss your heads when standing in harness? Why do you stretch open your mouths, shake your heads, and gnash your

* The dray horses in London exhibit the most painful examples of the cruelty of using a tight bearing-rein. Whether at work or standing they will be found in continual torment—tossing their heads, or resting the weight of them on the bit, and so drawing back the corners of their mouths, as nearly to split the ligatures;—at work, instead of going on steadily, they, "bob" their heads, feeling the check at every step they take.

* Archimedes said, "Give me a place to stand on and I will move the world."

teeth? Why do you turn your heads back towards your sides, as if looking at the carriage? they would answer—all, all this is done to get relief from the agony we are enduring by having our heads kept erect, and our necks bent by tight bridles.

To ladies the editor would appeal with earnestness. His heart has ached when passing the horses of the nobility and others at the doors of houses in London, to see the unceasing motion of the heads of the poor creatures, the coachmen sitting at their ease, perfectly unconcerned, and often doubtless unconscious of the agonizing pain of the muscles and sinews of the neck the horses are enduring. No humane person could knowingly suffer such cruelty to be practised. It is true that to the eyes of ignorant people, horses tortured with the bearing-rein look "very fine," but the true connoisseur will never be pleased at such distortions.

England, where the best horses and the best drivers are to be found, England (it is said) is the only country in which that bane of the horse, the bearing-rein, is used! In France it is not used, and, as the natural consequence, horses in that country seldom fall to the ground, or so as to hurt themselves. At the very instant a horse stumbles the French coachman slackens the rein, that the horse may save himself.

It is sincerely hoped that the entire removal of this punishing bridle will be speedily effected by the powerful aid of veterinary surgeons, by the owners and drivers of private carriages, noble and gentle, at once abolishing this useless, tormenting appendage; by the society for the prevention of cruelty to animals lending to this good object their aid unitedly as a body, and individually as members; by giving circulation in newspapers and periodicals to the experience of the good effects of going without them; by the public patronizing those vehicles in which the servants do not use the bearing-rein; by humane travellers feeing well those coachmen who in this respect obey the dictates of humanity, sound policy, self-interest, and common sense. The editor is aware that no good coachman would condescend to use bearing-reins, and persons much accustomed to travelling, if they see the horses come out with bearing-reins, immediately conclude the driver is one of the old school, or that he is not "up to his work;" and they are generally right, for it will be found that he is not able to command his horses so well as the man who drives without them. The least reflection will show this must be so. If the horses have bearing-reins they lean their heads on them, and the coachman's reins may be seen loose and dangling on the horse's back; if on the contrary he drives without, he has the horses in hand always, and guides them as he pleases. This is more plainly the case with post-chaise drivers and hackney coachmen, whose reins are only used occasionally when they have bearing-bridles, instead of being always tight in their hands.

The effect of bearing-reins upon coach-horses is shown at every stage when the horses are taken off. If they have bearing-reins they may be seen tossing their heads incessantly, although jaded, panting, and eveloped in steam: surely the poor creatures would not thus exert themselves in a state of great fatigue, if some greater distress were not affecting them. It is the agony of the sinews under the neck and throat, which being restrained so long, ache as if a man's arm were to be kept in a painful position. Horses which have done their stage without the bearing-reins, when taken off, stand with their heads down, breathing freely, and in comparative comfort. How often upon changing horses do we see the kind horse-keeper of a stupid bearing-rein coachman instantly unbear his horses and thus entitle himself from the humane traveller to the fee which the coachman had forfeited. At the time this paper is being published, the editor has remarked that bearing-reins are more used in Bristol by coachmen, and more cruelly tightened by carmen, than in any other place in the west of England; not only by carmen plying for hire, but by the drivers of the splendid dray-horses which are to be seen in that city.

REPORT TO THE STATE BOARD OF AGRICULTURE,

ON ELIZABETH CITY COUNTY.

By Dr. R. Archer, U. S. A.

Old Point Comfort, May 31, 1842.

Mr. Edmund Ruffin, Corresponding Secretary of the Board of Agriculture of Virginia.—I give you, as far as my avocations and limited information will permit, succinct and general replies to the queries of the Board of Agriculture, so far as they relate to the county of Elizabeth City.

An inspection of the map of Virginia will show that, in a geographical point of view, our county is not surpassed by any in the state. Bounded on three sides, and intersected in various directions by navigable streams, the facilities of transportation to market, will bear a comparison with those of the most favored region of our country. From no part of the county has the farmer to cart his produce more than five miles, and in many situations the vessel anchors within a stone's throw of the barn. In three or four hours she may be in Norfolk, in 20 or 30 in Richmond, Petersburg, or Baltimore.

The average length of the county is 10 miles; the average breadth $8\frac{3}{4}$. The surface is decidedly flat; and the elevation above tide water is in few places more than 10 feet; the average elevation not more than 6 or 7 feet. It is apparent, then, that a considerable portion of the surface must be occasionally overflowed, and that our rivers and creeks must be bordered by extensive salt marshes. The ordinary rise and fall of the tide is from $2\frac{1}{2}$ to 3 feet. The highest gust tide within the last twenty years, rose 4 feet above the ordinary high water mark. The highest land is on James river; from thence it slopes back to Back river, into which most of our waters fall.

The climate of Elizabeth City, in consequence of the proximity of the ocean, is very variable. East winds prevail extensively, and are always attended with chilliness and extreme dampness. In summer the sea breeze generally sets in in the afternoon, and to intensely warm mornings usually succeed cool and pleasant evenings: indeed, a sultry morning is considered a sure harbinger of a pleasant evening.

For the last five years, the mean height of the

thermometer observed at sunrise, 2 P. M. and 9 P. M., at Old Point Comfort, and the quantity of rain in inches, have been as follows:

	1837.		1838.		1839.		1840.		1841	
	Ther.	Rain.	Ther.	Rain.	Ther.	Rain.	Ther.	Rain.	Ther.	Rain.
Jan.	32	1.6	45	2.7	39	8.1	35	1.6	42	11
Feb.	38	2.5	33	1 8	43	4.7	47	3.2	39	3.2
March	45	2.4	48	2 1	48	5 3	52	4.	48	8.5
April	54	.9	55	2 8	57	3.7	61	5.9	54	6.3
May	65	2.2	64	1.1	69	5.5	68	5 9	63	4 2
June	75	3.5	75	4.5	73	4.8	74	11 1	77	3.6
July	79	2	82	2.4	80	4.5	76	13.5	78	3.6
August	77	8	81	1 2	75	14.2	79	5.5	77	8.9
Sept.	74	5.2	72	16.4	69	1 2	69	7.6	74	6.4
Oct.	64	.5	59	4 6	63	6 8	63	6.4	57	1.5
Nov.	54	2.9	48	3.7	48	3.6	50	2.8	52	2.5
Dec.	46	9	38	1.6	39	9.6	45	6.6	45	5.6
	58½	40.7	58⅓	44 9	58½	72	60	74.1	59	65.2

The climate may therefore be considered a mild one. Lettuce and cabbage plants stand the winter with slight protection, and the fig-tree rarely suffers. The live oak, though by no means a general forest tree, grows luxuriantly in many places, and appears here very nearly to have reached its northern terminus.

The soil of Elizabeth City, for the most part, consists of a light sandy loam about seven inches deep, based invariably on stiff clay. In the Back river country it contains a much smaller proportion of sand, and is consequently stiffer and more difficult to work. Extensive alluvial deposites are found in the neighborhood of most of our water courses, containing large quantities of marine shells in all stages of decomposition, imbedded in a dark rich vegetable mould, commonly called Indian banks, from the supposition that they were deposited by the Indians. Shell marl has been found at the heads of some of our creeks. One sample, that I analyzed, yielded about 65 per cent. of lime. In the Back river district no vestige of marl has been discovered, although the Indian banks are abundant. Green sand has been found on James river, a few miles above Newport's Noose. I have heard of but one experiment with it, and that did not result favorably. Nor have the experiments with marl been generally successful; from the fact, I believe, of its having been too freely used on land entirely deprived of all vegetable matter. On the farm adjoining Hampton, owned now by Mr. Jefferson Sinclair, it has been of serious disadvantage. It was applied by the former proprietor at the rate of from 250 to 500 bushels per acre. Neither corn, wheat or oats were grown upon it. Clover and Palma Christi appear to be the only crops at all capable of resisting its deleterious influence.

Your opinion, that the lands in lower Virginia are entirely devoid of calcareous matter, must be received with some modification. I have analyzed soil taken from four different parts of my farm on Hampton Roads, all high land, and found in each instance a portion of lime. This, in conjunction with the fact that marl, except in very small quantities, has invariably proved injurious when used in this neighborhood, would go far to prove that our lands in the south-east part of the county contain a fair proportion of lime. Do not understand me to say that they contain enough; for on the very fields where I found lime by analysis, I am using the Indian banks with manifest advantage, especially to the clover crop.

The following is about the average analysis I made of my soil. 440 grains of earth contained of

Water of absorption, - -	15 grs.
Coarse silicious sand and gravel,	8
Undecomposed vegetable fibre,	1
Fine silicious sand, - -	353
Calcareous sand, - - -	5
Carbonate of lime, - -	4
Vegetable matter destructible by heat, - - - -	7
Silica, - - - -	27
Alumina, - - - -	7
Vegetable and animal extract,	3
A trace of magnesia.	
Loss, - - - - -	10
	440

Our water is good and abundant. We have springs, but our supply is usually derived from wells. We have rarely to dig more than ten feet. In summer our out cattle frequently suffer for want of water; there is no excuse for this, as it could be so easily remedied by sinking wells in the neighborhood of their ranges. But in lieu of these, we resort to water holes scooped out to receive the rain water, that at certain seasons covers our woods. This supply in course of time becomes stagnant and putrid, and ultimately dries up.

In this county we may safely say, that we suffer more from wet than drought.

Where water-power is used for manufacturing purposes, we rely exclusively on the tide-water, by damming up the heads of creeks. In this way we get a small fall, which enables the miller to grind about fifteen hours out of 24, on both the flood and ebb tides. Mr. Dubre has on Back river a mill on this construction which grinds excellent meal and flour.

We have no mill ponds in the county. There was a few years past, a very extensive one on the county road leading to Yorktown, but the property has recently fallen into the hands of Mr. William McClain, who proposes to convert it into an artificial meadow. He has already expended a large sum in tide gates, ditching and embankments, and is sanguine of success. This will be a most important improvement, as it will at once break up a hot-bed of deadly malaria.

The proportion of cleared to uncleared land I have no correct means of knowing, but we have estimated as follows: two-fifths in arable land, one-tenth in waste land, and the remainder in woods.

A large portion of the wood land is covered with a second growth of pine, having been once under cultivation and turned out.

Very little has been done in the way of artificial meadows, and our natural meadows consist chiefly of salt marsh. These afford extensive and luxuriant grazing, and in some situations the cattle are raised exclusively upon them, having never tasted a grain of corn, or blade of fodder.

The amount of hay cured is very limited; none is offered for sale, and I presume not more than 50 acres are annually mowed. This is the more surprising, as all the artificial grasses thrive

perfectly well here, and the Back river country seems peculiarly adapted to them. At Brierfield, on James river, Mr. Bartle has been making hay for 15 or 16 years. Mr. Andrew McClean continues the system, and thus supplies the principal provender for a large stock of horses and cattle. The great obstacle to the successful cultivation of artificial grasses here appears to be the rapidity with which weeds and the natural grasses grow; but this I have no doubt can in a great degree be remedied by cleansing the land by proper tillage and thick sowing: to use grass seed sparingly is to throw it away, and lose the use of your land besides.

The use of clover is extending rapidly, and few farmers of any intelligence entirely dispense with it. Twenty years ago it was unknown as a field crop; now the clover field is as extensive as the wheat or oat field, but it is grazed and turned in for wheat.

Our farms are generally small, varying from 100 to 800 acres, average about 200. The old three-shift system is still the prevailing one. Many have adopted the four-shift, as they find they cannot enjoy the full benefit of the clover fallow with the old rotation. I prefer the four-shift; and my rotation is corn, oats, clover, wheat.

Corn, wheat and oats are our staple; no tobacco is raised. A few years since the Palma Christi was extensively cultivated, but it is found to be an expensive crop, and is now almost totally abandoned. The farmer who raises this crop, usually has to buy his corn and fodder; and the condition of his stock in the spring speaks a language which cannot be misunderstood. It is a great exhauster and returns nothing to the land.

The cultivation of the sweet potato has been considerably extended within the last three years, and promised to become a profitable crop; the losses, however, sustained last year, from not meeting with the expected demand from the north, have deterred many this year from prosecuting the culture. The farmer, however, has this consolation, if he cannot sell them, he can feed them to his hogs, and, next to corn, I know of nothing he could raise to more advantage for them.

The mode of culture here is as follows:

Prepare a rich bed with unfermented stable manure, in a dry situation, and as early as possible in the spring; when all danger from frost has passed, lay the slips or small potatoes side by side all over the bed, and cover them about an inch deep by sifting rich mould over them. Leave them to sprout.

Having thoroughly manured your land, which should be the lightest and poorest you have, break it up well and drag; cross plough it and drag it again and again, until you get it well pulverized; list it by throwing two or three furrows together with a small plough, leaving the ridges or lists two and a half or three feet apart; run a garden rake lengthwise over the ridges to level the tops and rake off the clods. The land is now ready for planting.

When your potato sprouts are three or four inches high, pick them out of the bed by pulling them up with one hand, whilst with the other you prevent the displacement of the potato by pressing on it. Set them out with a dibble as you do cabbage plants, from 18 to 20 inches apart. Keep them clear of grass with the hoe; reset where they are missing; run the cultivator through the middles, and when the plants are of sufficient size and have commenced running freely, throw a furrow from the middles to the bed on each side. A boy should follow after the plough to uncover the vines. This completes the cultivation, and in a short time the ground is completely covered. The vines throw out small roots from each joint, which immediately take hold of the earth: it is thought best to break this connexion, and it is recommended to go after a rain with a rake or crooked stick and pull them up in the middles.

The crop is harvested by throwing down the beds on each side with a plough, taking out the potatoes with the hand or a hoe, or throwing them out by a third bout of the plough. They are then assorted, and the smallest reserved for seed for the next year, although the slips are generally preferred. These are made by cuttings from the vine 12 or 18 inches long, covered up in the ground, leaving one or both ends out, and worked as the general crop is.

The great art in preserving the potatoes or slips through the winter, consists in putting them away in good order. If they are bruised or skinned they will invariably rot. They should be handled as little as possible, and it is therefore best to take them directly from the field in baskets and place them where they are to remain through the winter: have no second or third handling. A warm dry cellar is the best place to keep them in. Make a good bed of pine leaves, lay the potatoes on it in a pile; let them remain so with the door or window open, to undergo their sweat; and when the season is so far advanced as to threaten frost, cover them well with pine leaves and close the doors and windows tight. Occasionally, during the winter, when the weather is fine and warm, you may admit the air and sun for a short time, to carry off any dampness that may have collected in the cellar.

In the cultivation of our staple crops almost every farmer has his own peculiar fancy. In the corn crop, the plough, and more especially the hoe, are much less used than formerly. The harrow and cultivator accomplish the principal part of the work. Few think of hoeing their corn more than once, and some dispense with it altogether. Their answer is, "they can't afford to use the hoe." The public works have so enhanced the price of labor in this neighborhood, that a much smaller farm force is used than formerly. I am of opinion it might still be reduced to advantage. We cultivate too much land: if we would throw out one half of our fields to rest, under a cover of clover and other grasses, we might dispense with one half of our laboring force of negroes and horses; and in two or three years the one half would produce more than the whole did before.

We usually plough about four inches deep. Some of our old-fashioned farmers still go on the scratching system, for fear of turning under the rich top soil; but deep ploughing is becoming decidedly the fashion. On our light lands the ground is broken up flat in the spring for corn, which is planted as soon thereafter as practicable, say from the first to the tenth of April. On Back river, where the lands are stiff and wet, this system would be impracticable; they plough as early

in the winter as they can, throwing up the land in beds, and replough in the spring.

On good land the twin corn is preferred to all others.

Most of our wheat is sown on corn land at the rate of about three pecks to the acre; few farmers exceed a bushel. The advantage of the fallow system, however, is gradually developing itself, and we estimate the product on fallow land at one-third more than on corn land. This is not to be ascribed entirely to the improved condition of the soil, but measurably to the opportunity it affords for early seeding, and the better preparation of the land. We usually sow the bearded golden chaff.

When the land will allow, that is, where it is not liable to suffer from standing water, we prefer the flat tillage; wherein it is thrown up in beds about five feet wide for corn, and ten or twenty for oats or wheat.

Our average product per acre throughout the county may be estimated at 25 bushels of corn, 10 of wheat, 20 of oats, and 150 of sweet potatoes.

Ruta baga turnips have been extensively cultivated by some of our farmers, but generally our patches do not exceed an acre. We sow about the first of July; the land being well manured, thoroughly ploughed, harrowed and listed; the lists or ridges flattened by running a light harrow over them. We leave the plants about 12 or 14 inches apart on the ridges. The principal work is effected with a narrow cultivator, and when the plants are of sufficient size to receive the dirt, a furrow from the plough is thrown to them from each side. This completes the cultivation.

On a small scale every farmer might cultivate the ruta baga or mangel wurtzel beet to advantage, because they would not interfere materially with his general crop, and are certainly a very agreeable change of food to his stock in the winter; but I doubt whether it would be profitable to go largely into their culture. They are a troublesome and rather uncertain crop, consuming an immense quantity of manure, and, withal, yielding but little nutriment. According to Sir Humphry Davy, 1000 parts of ruta baga yield but 64 parts of nutritive matter, whilst the Irish potato yields 200. One bushel of potatoes, then, is worth three bushels of turnips; and an acre of potatoes is cultivated at less than one half the labor required for an acre of turnips. Mangel wurtzel yields about 148 parts in a thousand, but they occupy the ground from March to October, and consequently require a great deal of labor.

Our principal implements consist of the cast-iron mould-board plough, the cultivator and harrow. Of ploughs we have many varieties, but the Freeborn is in most general use. I have used Chenniworth's self-sharpening plough for three years past, and am highly pleased with it. Prouty and Mear's premium plough was introduced with a loud flourish of trumpets last year, but proves to be worthless: it will do good work in very clean land, but choke immediately where there is grass. It is moreover very expensive: one for a single horse, sent to me from Boston, cost, delivered here, upwards of $8. Davis' plough is highly recommended by all who use it; it does excellent work, and is little liable to choke.

It is very important that a farmer should adopt one particular variety of plough. The advantage is manifest, for then the parts of one will fit another, and a broken plough can at any time be repaired by the fragments of another. This rule should not be confined to ploughs, but should extend to carts, wheels and axles.

The use of the roller is gradually extending through our county. I have found it an invaluable implement, peculiarly adapted to our light soils. I usually plough in my wheat and oats; if the land is very rough, I run a harrow over them and follow with the roller, but generally the harrow is dispensed with. The roller leaves the land in beautiful order for the scythe.

Thrashing machines of various patterns are in use with us. Parker's is highly spoken of. I prefer Sinclair and Moore's horse-power to any I have seen. They all work well if well managed, but in the hands of careless negroes and overseers are good for nothing. Upon the whole, I think the small farmer had as well dispense with them; he can tread out his two or three hundred bushels of wheat in four or five days, and with a small machine he can do no better. A new corn and cob crusher has been recently introduced by two or three of our farmers. They speak in the highest terms of it as performing all that was promised by the patentee. The cob is crushed by passing through iron cylinders.

Our fences are usually made of pine rails. When convenient, oak is used. In the James river district chestnut is found, and is of course preferred to any thing else. We have no stone, and there is not a live fence or hedge in the county.

Our cattle and hogs are improving. The Durham and Devon stocks have been introduced with decided advantage. The Berkshire hog is highly lauded by many, whilst others contend that the same care bestowed upon our native stock would make them equal to the Berkshire. Two gentlemen who purchased a boar and sow each from Bement, after getting one or two farrows, have sold out, considering them worthless, and are breeding now in preference from the New Jersey grass hog. On the other hand, a gentleman on Back river, who purchased from Lossing, says there is no comparison between his Berkshires and any other hog he ever saw. The fact is, there are no doubt good as well as bad Berkshires, and a bad Berkshire is very little, if any better, than any other bad hog. The hog mania, however, has had the effect of attracting the farmers' attention to the subject; and in that way, I believe, more than by the introduction of any new breed, have our hogs been improved. We feed better than we did two or three years ago.

Horses are chiefly used for the labor of the farm: a few prefer mules, and you may occasionally see a yoke of oxen attached to the plough. We raise no stock for exportation.

Of dairy management I can say nothing. Very little butter is made beyond the requirements of the farmer's family. The time however is not distant when this will form an important branch of our agriculture. The lands on Back river are peculiarly fitted for pasturage; they are covered with white clover, and the increasing demand for butter will ere long effect a change in that region. The prevailing growth upon our wood lands is oak, hickory, pine, gum, elm, walnut, locust, maple, sycamore, beech and chestnut. The chestnut is confined to that region of country bordering on James river.

Our wood lands afford good ranges for our cattle and hogs during nine months of the year. In mild winters they can subsist on them, and keep in pretty good plight without any other food.

Some pine wood is cut for the northern market, but in no great quantity.

Under the head of "obstacles to improvement" I will enumerate, first, *the facility of living without labor.* Experience shows that, in this country, if not in all others, the improvements in agriculture are in the inverse ratio of the facilities of procuring subsistence. Perhaps in no part of the state are these facilities greater than here. With fish and oysters at our very doors, a man can in one hour catch enough to subsist a family a whole day. The great mass of population in all countries labor almost solely for subsistence: the fear of starvation is the strong incentive to exertion; here that incentive is unknown, and unless a man looks forward to a higher destiny than that of a mere fisherman, he will be content to live from day to day at the smallest expense of bodily labor. This is unfortunately the case with the great body of the lower class of our white population. It is unproductive labor, and returns nothing to the common stock, but rather takes from it; for in time this fisherman dies, leaving his wife and children a legacy to the public charity. The labor of the county is taxed to support the family of a man who never contributed one cent to the revenue; the children are brought up in ignorance and idleness, and as soon as they are large enough, follow in the footsteps of their illustrious progenitor: and thus they move in a circle, the fourth generation no farther advanced in refinement, education or morals, than their great grandfather. It is this state of things, coupled with our injudicious system of public charity, that has brought our poor rates to 75 cents a year on each tithable.

But this aversion to labor is not confined to the lower class; it unfortunately pervades the higher, and grows out of the fact, that it is in some way considered disreputable, because it is the province of the negro. The consequence is, that many become poorer just in proportion as their families increase. Their half dozen negroes and worn-out fields afford them a living; but they get married, and in a few years have half a dozen children, all to be supported by the same negroes and worn-out fields, which are daily getting poorer. Thus no money is saved for improvement, every inch of the farm is urged to the utmost, and they either descend to the fisherman state, or, if too proud for that, sell out and move to the west, that golden region where people can live without working.

The *law of enclosures.* So much has been said and written on this subject, that it is hardly necessary to do more than to enumerate it as one of the obstacles to improvement. The time which ought to be devoted to manuring and improvement, is employed in making and repairing fences; not so much for the protection of our crops against our own cattle, as against those of others, who most frequently have no crops of their own to protect. If you cut down a worthless tree on my land, the law considers you guilty of a trespass, and you pay the penalty; if your horse or cow break into my field and destroy my corn, you have only to prove that my fence was one rail below the legal height, and I have no redress.

The *road law* operates injuriously, because it operates unequally and expensively. The county is laid off into districts, and an overseer appointed for each. He receives generally about one dollar a day for the time employed in supervising the hands on the road. This at once is a temptation with many to prolong the work to the utmost. He can summon all the labor of his district, whenever it may suit his personal convenience, without consulting that of any one else, or even if he were disposed to do so, a convenient time with one might be a very inconvenient time with another. If the road is any distance from home, the party rarely gets to work before 9 o'clock, and then they are knocked off an hour or two before sunset, as the overseer wants to get home. The hands are badly provided with tools; sometimes all hoes when spades or axes are required; then again spades or axes, and a scarcity of hoes; and thus one half are frequently idle for want of proper tools. Sometimes the whole force of his district, amounting to 30 or 40 hands, is required to mend a bridge or fill up a hole, that might be done by 3 or 4. He is afraid he might be accused of partiality, if he summoned Mr. A's negroes and not Mr. B's, and so calls all out, and here is a hole filled up at the cost of thirty or forty days' labor, when only three or four were required. The balance is of course so much dead loss to the production of the county.

It seems to me the object could be much better effected by imposing a moderate tax in money, as it is usually done in the northern states.

"Granting licenses to tippling shops, and non-enforcement of the law against those who sell spirits without license." This is a serious evil to our county. It exercises a baneful influence, not only on our negroes, but the lower class of our white population. They are tempted to drink, and having no money, pay perhaps four times as much for the indulgence, in stolen property, as the money value of the whisky. Nine-tenths of the petty larcenies committed here can be traced to the influence of the grog-shops.

REMARKS ON SOME OF THE CHEMICAL CHANGES PRODUCED IN THE DIFFERENT MODES OF PREPARING ANIMAL MANURES.

To the Editor of the Farmers' Register.

Tuscaloosa, Ala., June 17, 1842.

Sir:—I have just read, in the last (May) number of the Register, an article on urine, from "Squarey's Treatise on Agricultural Chemistry." It begins with an extract from "Liebig's Organic Chemistry of Agriculture and Physiology;" and is, indeed, a pretty correct abstract of an important and interesting portion of that very valuable work.

There are, however, two paragraphs, in which Squarey recommends a mode of employing urine, which Liebig condemns as "the most injudicious that could be conceived." As Squarey professes to adopt and recommend the principles so ably developed by Liebig—as those principles, if true, must, says Professor Lindley, "be the foundation of all exact and economical methods of cultivation"—and as their truth can only be established by the results of numerous experiments

performed in exact accordance with the views of their author—I have concluded to direct your attention to what I conceive to be an important error in Squarey's Treatise. He says,

"Another compost heap, which would answer admirably for any purpose almost for which a manure can be required, that is, either as a stimulant for turnips, as a pabulum for wheat, or white crops —or, again, as a top-dressing for either of the above, or for grass—may be readily formed by mixing long stable litter, in which decay has already commenced, with the burnt ashes of vegetables or wood, in somewhat indefinite portions; taking care, however, that the litter should predominate, and then pouring over the heap daily a portion of the putrid urine, and stirring the mass well up together.

"In this heap the ammonia of the urine would be decomposed; but the nitrogen, the vivifying principle of the ammonia, would unite with the alkaline matter, the soda or potash of the burnt vegetable ashes, to form nitrate of potash or soda: the hydrogen, the other constituent of ammonia, being given off."

In such a heap, the carbonate of ammonia, resulting chiefly from the decomposition of the urea of the putrefying urine, would be decomposed and lost. The nitrogen of the ammonia would, by combining with oxygen of the air, form nitric acid, which, by uniting with potassa, lime, alumina, &c., would give rise to various soluble nitrates. The manure so formed would be very valuable; but its action as a fertilizer would depend, not on the nitrates, if Liebig's opinions are correct, but on the phosphates and other salts, which, in such a heap, would escape decomposition, and which are very valuable ingredients of soils. Indeed, Squarey admits that the ammonia of the urine would be decomposed; and any one, who has attentively read Liebig's work, must be aware, that he ascribes much of the efficacy of urine as a manure, to its ammoniacal salts, and attaches no importance to nitrates, even in the culture of plants, part of which contain nitrates.

"Ammonia, (says Liebig—Webster's edition, 1841, p. 138,) by its transformation, furnishes nitric acid to the tobacco plant, sun-flower, chenopodium, and borago officinalis, when they grow in a soil completely free from nitre, (nitrate of potash.) Nitrates are necessary constituents of these plants, which thrive only where *ammonia* is present in large quantity, and where they are also subject to the influence of the direct rays of the sun, an influence necessary to effect the disengagement, within their stems and leaves, of the oxygen, which shall unite with the nitrogen of the ammonia to form nitric acid."

Hence it appears, that Liebig believes the conversion of ammonia into nitric acid, to be in such plants as tobacco an essential process of assimilation. If this be true, (and Squarey says "the powerful influence of urine must consist in its ammoniacal salts,") the process recommended by him must deprive the urine of its most abundant and most valuable ingredient. And if the nitrates, found in plants, are products of processes of assimilation, such salts, presented ready formed to their roots, can have no good effect, and may have a bad one. At all events, it has been ascertained that such plants grow well in soils which do not contain nitre.

I am aware that Squarey's, or a similar mode of employing urine, is recommended by some scientific men, and that it is practised successfully "in the vicinity of some of the large cities of the United States." This, however, does not prove that it is the best mode of employing urine. Scientific men have devoted very little time to the investigation of the subject; for, as Liebig remarks, "since the time of the immortal author of the 'Agricultural Chemistry,' no chemist has occupied himself in studying the applications of chemical principles to the growth of vegetables." And the practice of our most intelligent agriculturists is often erroneous; and the apparent success of that which I am now opposing, proves only, what every chemist, acquainted with the nature and number of the salts of urine, would expect, that it is a valuable manure, when deprived of that ingredient, which is most fertilizing, and of which it contains the largest quantity.

Liebig describes several modes of preparing manure from human and animal excrements, both fluid and solid, which he characterizes as "the most injudicious which could be conceived." And the principle of Squarey's method is expressly condemned.

"In other manufactories of manure, the excrements while soft are mixed with the *ashes of wood*, or with earth, both of which substances contain a large amount of caustic lime, by means of which a complete expression of their ammonia is effected, and they are completely deprived of smell. But such a residue can act only by the phosphates which it still contains, for all the ammoniacal salts have been decomposed, and their ammonia expelled." (*Webster's edition*, 1841, p. 243.)

It would, therefore, be much better to employ wood ashes, lime, and other alkaline substances, in the way recommended by Liebig, which is to scatter them over the surface of the soil, exactly as the planter sows wheat or oats; for though these alkaline substances are valuable manures, they all have a greater or less tendency to decompose ammoniacal salts, and to expel their volatile alkali, ammonia. It is however an advantage, where the soil contains a proper mixture of alkaline substances; for the ammoniacal salts of the manures, formed from animal excrements, coming gradually into contact with them, are slowly decomposed during the growth of the crop, and the ammonia, while in a nascent state, is presented to the rootlets of the plants, in the best possible form for absorption. This is the mode that has, for years, been adopted with so much success in Scotland; and the practice of that nation is in exact accordance with the views of Liebig.

There is not, it appears to me, any way in which ashes, lime, or other alkaline substances, can be economically applied to compost heaps formed of animal excrements. Gypsum, copperas, or some other similar salt, which readily yields its acid to ammonia, should be spread over the heap and mixed with it; or sulphuric acid, very much diluted with water, should be mixed with the liquid excrements, before they are poured on it; or it should be mixed with burnt clay, ashes of coal, pulverized charcoal, or some other substance which has a powerful affinity for ammonia; or it should contain so much litter as to absorb most of the putrid urine, and thereby pre-

vent the escape of most of the ammonia. In all cases, the heap should be protected from rain, by a good shelter. R. T. B.

STALL-FEEDING.

Directions to stall-feed Cattle—read before "The Philadelphia Society for promoting Agriculture," June 1, 1842, by James Mease, M. D., Vice President.

From the Philadelphia Saturday Courier.

1. The subjects on which it is intended to lay an extra proportion of fat must be in good condition when put up—otherwise they will not pay for the cost, feed, and care.

2. Give one handful of fine salt three times weekly to each beast.

3. The hay must be of the first cutting, (if clover) and well cured—that is, not left before cutting, in the field, until the stems are deprived of all nutritious moisture, the leaves and blossoms turned black, and when cut, turned day after day in making, until they fall off from age, and exposure to the sun, and probably a rain or two. These consequences (the last excepted) are the invariable result of sowing timothy with clover seed, for the first grass does not attain its full growth until two weeks after the latter is fully ripe, and farmers almost always refuse to cut the crop until the timothy is fit to mow. The union of orchard grass with clover does not admit of the objections to which the first combination is liable, for both progress equally to maturity, and if cut when in full blossom, and not kept too long in the field, make a hay which cannot be exceeded. Hay should be given thrice daily, and no more put in the rack at a time, than the animals will eat before their next allowance, as they become fastidious by confinement, and will refuse hay upon which they have often breathed, and which is also impregnated with the confined air of the stable. At night, enough must be given to last until the morning, and the remains of the former supply at all times taken away, to give place to a fresh one.

4. Water is to be given twice a day, and, if convenient, the animals may be walked to the spring, creek, or pump. The exercise will amuse them, promote their appetites, and aid of course the object in view.

5. After their hay is eaten, give from 10 to 16 quarts of Indian corn and oats ground together, to each head three times daily during ten days; then half a peck of boiled mashed potatoes, with a handful of corn meal sprinkled over them. The water in which the potatoes have been boiled must be thrown away, as I know it to be hurtful to animals. In a week, a change may be made of chopped pumpkins, or sliced Swedish turnips, or sugar beet, for the potatoes. The new food will invariably encourage appetite, unless in the event of an aversion to some one article, for which no cause can be assigned. Indian corn meal, with or without oats, must be the never-failing accompaniment of any other food.

6. Great care must be taken to watch the appetite of the animal, so as never to cloy it; otherwise time will be lost. He must on no account be over-fed—and to avoid this, during the occurrence of an increase of temperature in the air, (or "*a warm spell,*") which takes place almost every winter, the usual allowance must be diminished. The farmer should take the alarm the hour that he sees the animal leave any of his usual allowance in the trough or rack, clean out both, and by a daily walk, extra carding, and, if necessary, a dose of Glauber salts, try to restore the appetite.

7. The food, other than hay, should be given in a box and in the trough alternately, which should be daily washed or dry-scrubbed, and scraped, to prevent the remains of a former mess from turning sour, which will infallibly disgust the ox. This was the uniform practice of that first-rate farmer, Joseph Cooper, of New Jersey, who urged its adoption upon the writer, as one with the importance of which his own ample experience had fully impressed him.

8. Flax-seed jelly, with corn meal, is of service occasionally to soften and loosen the skin, and produce that "kindly feel" in it which the great English improver, Bakewell, ranked as an essential point in the choice and feeding of cattle; meaning thereby a "mellow, soft feel, yet firm to the touch, and which is equally distant from the hard dry skin peculiar to some cattle, as it is from the loose and flabby feel of others."

9. Carding the animal thrice daily with appropriate cards is an all-essential part of the process. The operation is highly grateful to the animal, and its effects eminently salutary. It promotes the action of the small vessels on the surface, and the muscular fibres, which sympathise and act indirectly upon the stomach. Medical men are well acquainted with the intimate connexion subsisting between the state of the human corporeal surface, and the stomach and viscera connected with digestion, and the same connexion is observed in the ox when feeding.

10. Regularity in the hours of feeding and watering is essential.

11. Cut straw, free from mould or smell, may be given once a day, by way of a change, slightly sprinkled with corn meal and salt. It will be eaten freely. The stable should be fully ventilated, if possible—for the more pure the air, the more keenly will the animals eat.' The utmost attention must also be paid to cleanliness. The animals must not be permitted, when leaving the stall to drink, to walk through a yard covered with wet manure, and to return to their stalls with the clefts of their feet filled therewith—for, owing to the acrimony of the liquid a sore therein will be the almost certain effect, with a consequent loss of appetite. This cleft must be occasionally examined in both oxen and sheep, and if found sore, should be washed with soap and water, when the application of a dossil of tow, dipped in spirits of turpentine, morning and evening, for three or four days, will remove it.

12. Clean bedding is a point obvious to all.

TAMING HORSES—HORSE TRAINING.

By A. J. Ellis, B. A., Windsor, Oxley.

From an English Paper.

Mr. Catlin, in his work on the manners and customs of the North American Indians, gave the following account of their method of taming the wild buffalo calves, and wild horses:—

"I have often, in concurrence with a well-known custom of the country, held my hand over the eyes of the calf, and breathed a few strong breaths into its nostrils; after which I have, with my companions, rode several miles into our encampment, with the little prisoner busily following the heels of my horse the whole way as close and affectionately as its instinct would attach it to the company of its dam. This is one the most extraordinary things that I have met with in the habits of this wild country; and although I have often heard of it, and felt unable exactly to believe it, I am now willing to bear testimony to the fact, from the numerous instances which I have witnessed since I came into the country. During the time that I resided at this point, in the spring of the year, on my way up the river, I assisted (in numerous hunts of the buffalo, with the Fur Company's men) in bringing in, in the above manner, several of these little prisoners, which sometimes follow for five or six miles close to our horses' heels, and even into the Fur Company's fort, and into the stable where our horses are fed. In this way, before I left for the head waters of the Missouri, I think we had collected about a dozen."

In the same way the wild horses are tamed. When the Indian has got him well secured with the lasso, and a pair of hobbles on his feet, "he gradually advances until he is able to place his hand on the animal's nose, over his eyes, and at length to breathe in its nostrils, when it soon becomes docile and conquered; so that he has little more to do than to remove the hobbles from his feet, and ride it into the camp."

Mr. Ellis chanced to read this account when on a visit in Yorkshire, and forsooth resolved to try the experiment. He and his friends were alike incredulous, and sought amusement from the failure rather than knowledge by the result—but two experiments, all he was able to try, were both successful. Here are the particulars of one of them:—

"Saturday, February 12, 1842.—While the last experiments were being tried on the yearling, W. espied B., a farmer and tenants, with some men, at the distance of some fields, trying, most ineffectually, on the old system, to break a horse. W. proposed to go down and show him what effect had been produced on the yearling. When the party arrived at the spot they found that B. and his men had tied their filly short up to a tree in the corner of a field, one side of which was walled, and the other hedged in. W. now proposed to B. to tame his horse after the new method. B., who was aware of the character of his horse, anxiously warned W. not to approach it, cautioning him especially against his fore feet, asserting that the horse would rear and strike him with the fore feet, as it had 'lamed' his own (B.'s) thigh just before they had come up. W. therefore proceeded very cautiously. He climbed the wall, and came at the horse through the tree, to the trunk of which he clung for some time, that he might secure a retreat in case of need. Immediately upon his touching the halter, the horse pranced about, and finally pulled away with a dogged and stubborn expression, which seemed to bid W. defiance. Taking advantage of this W. leaned over as far as he could, clinging all the time to the tree with his right hand, and succeeded in breathing in one nostril, without, however, being able to blind the eyes. From that moment all became easy. W., who is very skillful in the management of a horse, coaxed it, and rubbed its face, and breathed from time to time into the nostrils, while the horse offered no resistance. In about ten minutes W. declared his conviction that the horse was subdued; and he then unfastened it, and, to the great and evident astonishment of B., who had been trying all the morning in vain to get over it, led it quietly away with a loose halter. Stopping in the middle of the field, with no one else near, W. quietly walked up to the horse, placed his arm over one eye, and his hand over the other, and breathed in the nostrils. It was pleasing to observe how agreeable this operation appeared to the horse, who put up his nose to receive the puff. In this manner W. led the horse through all the fields to the stable yard, where he examined the fore feet of the horse, who offered no resistance, but while W. was examining the hind feet, bent its neck round, and kept nosing W's back. He next buckled on a surcingle, and then a saddle, and finally fitted the horse with a rope. During the whole of these operations the horse did not offer the slightest resistance, nor did it flinch in the least degree."

Two experiments are all Mr. Ellis has had opportunity of either witnessing, or hearing the results of. But, as he states, these have been to him perfectly satisfactory; and, as he has no opportunity of carrying them on, since he is unacquainted with the treatment of horses, and neither owns any, nor is likely to be thrown in the way of unbroken colts, he has resolved to publish these particulars, that gentlemen, farmers, trainers, and others, may at least try so simple a plan, and thus test and determine its value. Mr. Ellis is of opinion that this is the secret of the celebrated Irish horse tamers; and we remember that in more than one recorded instance of their power, they pretended to whisper to the animal, and played with his head, and thus probably breathed in his nostrils.

SCIENCE AND AGRICULTURE.

Extracts from a Review of Johnston's Lectures on Agricultural Chemistry and Geology.

From Blackwood's Magazine, for June, 1842.

The atmosphere consists chiefly of hydrogen and nitrogen, but contains also a very small proportion of carbonic acid—one gallon in two thousand five hundred. This carbonic acid consists of oxygen and carbon only—it is the gas that escapes from soda water and sparkling champagne. The leaves and other green parts of plants, in the sunshine, absorb it from the air, decompose it, as chemists call the process, returning the oxygen to the atmosphere, and retaining the carbon. Plants thus clearly obtain carbon from the air, and in larger quantity in proportion to the extent of leaf they hang out, and to the duration of the sunshine. But the earth also contains vegetable matter, from which the roots draw part of their sustenance—of their carbon, that is—in the form of certain soluble organic compounds, which are naturally produced during the decay

of vegetable and animal substances. But here physiologists and chemists are at real or apparent variance with each other, in regard to the amount of carbon which plants derive from the soil. The old physiologists, and some of the less instructed of the existing race, seeing that soils rich in vegetable matter gave generally luxuriant crops, that by adding vegetable and animal manures to these soils they were rendered still more productive, and that the quantity of carbonic acid in the atmosphere was so very small—have generally advanced and maintained the opinion that the sustenance of plants—their carbon—is chiefly derived from the soil—that what they draw from the air forms but a small portion of their actual substance. This opinion has been subjected by its defenders to strange twistings and stretchings, to account for such facts as these. A field almost destitute of vegetable matter is laid down to grass, when year by year, though depastured all the while, the vegetable matter increases, till at length four or six inches of rich, dark, vegetable mould are formed upon its surface. Or a waste is planted with trees, which every succeeding autumn shed their leaves on the surface, and though much is carried off in thinnings, and the entire forest is sent to market when the trees are of sufficient size, yet the soil contains more vegetable matter at the end of all this, than it did at the beginning. Or a tree falls across a stream, dams up the water, and produces a marshy spot, rushes and weeds spring up, mosses take root and grow, year after year new shoots are sent forth and die, vegetable matter accumulates, a bog, and finally a thick bed of peat is formed. Physiologists of the old school may doubt, but common sense tells us that the increase of vegetable matter in all these cases—of its carbon, that is —must have been derived from the air.

This conclusion does not imply that a given plant or crop, that the individual grasses, or trees, or mosses, in our three cases, have not each derived a portion of their sustenance from the soil. The roots of our trees, for example, are continually drawing soluble organic matter from the soil, which they send up to the branches and leaves. But the quantity they return to it in the leaves they shed, and in the roots themselves, which remain buried, is something greater than what they thus send up; and thus the organic matter slowly increases. In our arable lands the same is shown by the slow decrease of vegetable matter through prolonged culture, and the consequent necessity of either adding a fresh supply of organic matter to maintain their fertility, or of leaving them for a time to a process of natural recovery. Still the question remains undecided between the two parties—what portion of their carbon do plants thus derive from the soil, and what from the air? It appears that *borage* has been long grown in Germany, for the purpose of ploughing in as a green manure. Nearly twenty years ago Lampadius, who has done much good service to scientific agriculture, made an experiment with the view of determining the amount of vegetable matter with which this plant was capable of enriching the soil. This experiment led him to the conclusion that borage draws no less than *nine-tenths* of its carbon from the air. Much, however, must depend upon the climate and soil; and later experiments have shown that the crops we usually cultivate for food derive, on an average, about two-thirds of their carbon from the air, and, consequently that, if we add to the soil, in the form of manure, one-third of what we take off in the form of a crop, we should maintain it in its existing state of richness, in so far as this depends upon vegetable matter, were there not other causes in operation which tend to lessen the amount of organic matter in soils that are continually turned up by the plough. Our author thus concludes his review of this question:—

"Being thus fitted by nature to draw their sustenance—now from the earth, now from the air, and now from both, according as they can most readily obtain it—plants are capable of living—though rarely a robust life—at the expense of either. The proportion of their food which they actually derive from each source, will depend upon many circumstances—on the nature of the plant itself—on the period of its growth—on the soil in which it is planted—on the abundance of food presented to either extremity—on the warmth and moisture of the climate—on the duration and intensity of the sunshine, and upon other circumstances of a similar kind—so that the only general law seems to be, that, like animals, plants have also the power of adapting themselves to a certain extent, to the conditions in which they are placed; and of supporting life by the aid of such sustenance as may be within their reach.

"Such a view of the course of nature in the vegetable kingdom is consistent, I believe, with all known facts. And that the Deity has bountifully fitted the various orders of plants—with which the surface of the earth is at once beautified and rendered capable of supporting animal life—to draw their nourishment, in some spots more from the air, in others more from the soil, is only in accordance with the numerous provisions we every where perceive, for the preservation and continuance of the present condition of things."

Another point in connexion with the organic food of plants, and especially the source of their carbon, has recently been brought into perhaps unnatural prominence by Liebig. The physiologists, believing that plants derived from the soil by far the greatest proportion of their carbon, naturally inquired what vegetable substances in the soil entered into their roots and ministered in the greatest degree to their growth. To vegetable matter, generally, they gave the name of *humus*, and to a dark brown substance which dissolves out of the soil, when it is boiled with a solution of common soda, the name of *humic acid* was applied. This humic acid being often met with in considerable quantities in fertile soils, has been generally mentioned by foreign agricultural writers as the principal source of that portion of the carbon which plants derive from the soil. It will be observed that this opinion may be entertained, without denying, at the same time, that plants derive the *largest* portion of their sustenance from the carbonic acid of the atmosphere. Liebig has shown that the humic acid and its earthy compounds are so sparingly soluble, that, were all the water which enters the roots of plants to carry with it as much of them as it could hold in solution, it would still convey to the stem and branches only a small fraction of the carbon they contain. So far Liebig's argument is unassail-

able; but there is a great gulf, as it appears to us, betwixt the obvious conclusion from this—that humic acid, namely, and its *earthy* salts, can contribute but *little* to the general nourishment of plants, and that which he affects to draw from it—that humic acid in no *other* way can directly contribute to the nourishment of plants, and that the only use of the entire vegetable matter in the soil is, by its decay, to yield carbonic acid to the roots. The compounds of humic acid, with potash, soda, and ammonia, are very soluble in water, and it has yet to be proved that they may not, especially in manured land, be present in the soil, and be thence taken up by the roots, while it is certain, also, that other soluble organic substances do exist about the roots, which, therefore, may enter into the circulation of the plant and aid its growth. In philosophical questions, a distinct line should be drawn between clearly established facts, or conclusions legitimately formed from them, and the mere opinions even of the most eminent men. On the whole, we are inclined to hold a middle way, and with our author to consider it to be satisfactorily established, that, while a plant sucks in by its leaves and roots much carbon, in the form of carbonic acid, it derives a *variable* portion of its immediate sustenance (of its carbon) from the soluble organic substances that are within reach of its roots.

This fact is never doubted by the practical husbandman. It forms the basis of many of his daily and most important operations, while the results of these operations are further proofs of the fact.

We pass on to another important question connected with the food of plants, in regard to which the views of our author differ to some extent from another of those opinions propounded in so broad and general a manner in the recent work of Liebig. We allude to the source of the nitrogen of plants. There are two compounds from which, according to our author, there is reason to suppose that plants, in the general vegetation of the globe, derive the greatest proportion of their nitrogen. These compounds are *ammonia*, which consists of nitrogen and hydrogen; and *nitric acid*, which is composed of nitrogen and oxygen only. The beneficial action of ammonia upon vegetation has been long recognized in practice, experimented upon by philosophical agriculturists, and brought prominently forward by writers upon theoretical and practical agriculture. It is given off in the gaseous state during the decay of the bodies and excretions of animals; and therefore wherever such are added, intentionally or otherwise, to the soil, the ammonia they yield must be considered as the source of a portion of the nitrogen which the plants that grow there are found to contain. In one of those numerous experimental papers with which Boussingault has enriched theoretical agriculture, he adverted to the opinion which had been long entertained by some that ammoniacal vapours probably float in the atmosphere in minute quantity, and suggested that those vapors might probably be a natural source of a portion of the nitrogen which is known to be present in plants. This opinion in regard to the presence of ammonia in the atmosphere, was founded upon the known fact that ammonia does escape into the air during the decay of animal substances, and that experimenters, Brandes, among others, as early as 1825, had found ammoniacal salts in rain water. Liebig, who also found a sensible quantity of ammonia in rain water, has recently been led to propound the opinion that *all* the nitrogen contained in plants enters them in the form of ammonia, and that the minute portion which floats in the atmosphere is the source from which they derive this ammonia when it is not present already in sufficient quantity in the soil. On reading his chapter on this subject, we could not help granting—what we were indeed prepared to concede, and in which all recent practical and theoretical writers concur—that ammonia is of great value in promoting vegetation, and that it is one source of the nitrogen of plants; but when we found ourselves in the midst of a paragraph, which assumed it to be proved that ammonia is the *only* source from which their nitrogen is derived, we fancied that we must have inadvertently missed an important step in the argument, and we turned back again and carefully retraced our steps in seach of the missing link in the chain of reasoning—but in vain. It *is* proved that ammonia is very useful to vegetation, and ought never to be wasted in good husbandry; but it is thence *assumed* by Liebig to be the only source of nitrogen to living vegetables. We are the more particular in insisting upon this, because the writer, borne away by his own belief, expresses himself as if he had really deduced his opinion from legitimate premises, and because we have seen many notices of his book, in which, what is merely an opinion of the writer, is really supposed to be proved. But we should be sorry to think that such an opinion was capable of proof, for we are quite sure that it does not truly represent the ordinary procedure of nature.

The author of the work now before us appears to be so far of the same opinion with ourselves, that he mentions another important source of nitrogen to the *general vegetation of the globe*, as he expresses it, besides the ammonia—namely, *nitric acid*, a compound consisting, as we have already said, of nitrogen and oxygen only. The arguments upon which he rests this opinion are stated in his eighth lecture, and are perfectly satisfactory. To us one authority, not quoted by Mr. Johnston, is conclusive. In a work of the celebrated Berzelius of Stockholm, now before us, and which was written in 1829, long before the opinions now in question were agitated, it is stated, "that every flash of lightning that passes through the air must produce a *not inconsiderable* quantity of nitric acid;" and we have seen enough of the incessant lightnings of South America, and of the thunders that precede the monsoons in India, to satisfy us that the quantity of nitric acid produced in the air must be really enormous. When, in addition to this, we recollect that the nitrates of potash and soda have been observed in all climates to promote vegetation when artificially applied to plants, we are inclined to think that in the following summary of his views, which for the sake of brevity we extract from his *Elements*, the agency of nitric acid is rather under than over stated by our author.

"Nitric acid is also naturally formed, and in some countries probably in large quantities, by the passage of electricity through the atmosphere. The air, as has been already stated, contains

much oxygen and nitrogen *mixed* together, but when an electric spark is passed through a quantity of air, a certain quantity of the two *unite* together chemically, so that every spark that passes forms a small portion of nitric acid. A flash of lightning is only a large electric spark; and hence every flash that crosses the air produces along its path a quantity of this acid. Where thunder-storms are frequent, much nitric acid must be produced in this way in the air. It is washed down by the rains, in which it has frequently been detected, and thus reaches the soil, where it produces one or other of the *nitrates* above mentioned.

"It has been long observed that those parts of India are the most fertile in which saltpetre exists in the soil in the greatest abundance. Nitrate of soda, also, in this country, has been found wonderfully to promote vegetation in many localities; and it is a matter of frequent remark, that vegetation seems to be refreshed and invigorated by the fall of a thunder-shower. There is, therefore, no reason to doubt that nitric acid is really beneficial to the general vegetation of the globe. And since vegetation is most luxuriant in those parts of the globe where thunder or lightning are most abundant, it would appear as if the natural production of this compound body in the air, to be afterwards brought to the earth by the rains, were a wise and beneficent contrivance by which the health and vigor of universal vegetation is intended to be promoted.

"It is from this nitric acid, thus universally produced and existing, that plants appear to derive a large, probably, taking vegetation in general, the largest portion of their nitrogen. In all climates they also derive a portion of this element from ammonia; but less from this source in tropical than in temperate climates."

Besides nitric acid and ammonia, there are other substances to which we believe plants owe a part of their nitrogen; but these, we allow, are to be considered as the most important, and we shall therefore hasten forward to the consideration of other topics.

When plants have obtained carbon, in the form of carbonic acid, hydrogen and oxygen in the form of water, and nitrogen in that of nitric acid and ammonia—how does the living plant transform these substances, so as to convert them into portions of its own substance? By what power is the alteration effected—by what succession of chemical changes is the final result brought about? This is a most interesting part of the subject, which our limits prevent us from attempting to enter upon. We may merely state, that the author shows, in a rigorously exact manner, how, in the interior of the plant, the starch of the seed is first converted into the sugar of the sap, how this is then converted into starch, or into woody fibre, and the latter again, when it is required, brought back into the state of starch or sugar. He shows also, how nearly all these changes can be imitated by the art of the chemist in his laboratory; and hence infers that what takes place in the interior of the plant, is no way mysterious in *kind*—it is mainly a series of purely chemical changes. But the mystery in living vegetables, as in living animals, is the process by which all these changes are regulated—which says, here such a change must take place, and to such an extent. A living plant is a cunningly contrived machine, of which chemistry can describe the wheels and the movements, but of which she may never be able to discover, certainly she can never hope to supply, the moving power.

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The second part of the *Lectures* is devoted to the inorganic constituents of plants, and to the geological and chemical relations of soils. We shall first complete our survey of the newest views in regard to the food of plants. We have already adverted to the fact that the various parts of vegetables, when burned in the air, leave behind a comparatively inconsiderable proportion of earthy or incombustible matter. Such is the common woodash, and such the ash left when heaps of weeds or the parings of our grass fields are burned. What is the use of this incombustible matter—what purpose does it serve in the plant—whence is it derived? Is it only present by accident—or does the healthy plant always contain it? Is its quantity constant, and does the same plant always yield the same kind of ash? For an answer to all these questions we must refer the reader to the works before us; but it will be interesting to trace the progress of opinion upon this branch of vegetable chemistry—not only because the subject is exceedingly curious in itself, but because the present state of opinion on this subject is connected with all the recent improvements in agricultural practice, has suggested many of them, and is now directing the enlightened farmer, often unconsciously, in all his most promising practical investigations.

The ash of plants, until a very recent period, was considered by the vegetable physiologists—who, indeed, esteemed themselves the judges paramount in this domain—as accidentally present, or at least as performing no important or necessary function in reference to vegetable life. No account was taken of it, therefore, in theory: and in practice—little as some may think agricultural practice in past times to have been affected by theory—in practice this opinion of the physiologists led to the adoption and justification of the most pernicious system of husbandry; for they naturally reasoned thus: If the organic or combustible part of plants be the only important, vital or essential portion, then, of manures such as are prepared in the farm-yard, it is also the only essential part—and in soils the vegetable or animal matter—the combustible parts of them, that is, which alone supply the plant with organic food—must likewise be the only essential portion. Accordingly, vegetable manures, or animal excrements, directly derived from vegetables, were alone considered necessary to fertilize the land and to feed the crop; and the vegetable matter in the soil was esteemed to be at once the source and the index of its agricultural capabilities. So firmly rooted was the opinion, and so widely spread, and so long has it lingered among practical men, that some of our readers may, even while they peruse these sentences, be unwilling to acknowledge, or have had no opportunity of being satisfied, that it is entirely erroneous. However, among other errors in practice, it led to the total neglect of the inorganic or incombustible part of the crops carried from the land. It was supposed that if a sufficient quantity of vegetable matter was always kept in the soil,

there could be no harm in carrying off what the land produced, or in neglecting that part of the crop which was of no economical value for any other purpose. We might illustrate this by a reference both to still existing, and to many now exploded practices among ourselves, but we rather advert to a custom prevailing among our transatlantic brethren, as described in the very interesting work of one of the best race of our own existing practical farmers. They grow wheat, sell the grain, and either burn or otherwise waste the straw. After wheat they grow clover, which they never cut, but plough in for green manure. The vegetable matter in the soil is thus kept up, all the conditions of the old theory are fulfilled, and yet the land is inevitably going to ruin. The father may not be aware that he is eating sour grapes; but the children's teeth are sure to be set on edge nevertheless.

Again, our West India planters, on their estates in Jamaica and elsewhere, find the land impoverished, and they hardly know why. There may be special local causes by which it is aided here and there, but the main cause is the same as in the United States. The canes are deprived of their juice in the mill, and the *trash*, as the refuse canes are called, is then burned to boil the sugar. The ash they leave is often considered as worse than useless—it is only a troublesome refuse.

Can any one doubt, after such examples as these, that all our practice is modified and has been modified by theory, either for good or for bad? Not that theory has at once said to the farmer, do this, and he hath done it, but the opinions of the vegetable physiologists gradually became a part of the general stock of knowledge among all well-informed men, and, through them, gradually influenced the agricultural practice in every country of Europe.

Then these same theoretical opinions led to curious shifts and contrivances in nomenclature. It was now and then observed, that the addition of inorganic matter to the soil, of wood and peat ashes, of kelp, of saltpetre, and a score of other things, produced a remarkable effect upon vegetation—increased the crop—hastened its growth—gave a heavier return of hay, of straw, and of grain. Was the plant *fed* by these things? Not at all. These were not *manures*, they were *stimulants*. And so we had some substances which were neither manures nor stimulants, but acted by fermentation; while many other like shifts were made necessary by the advance of knowledge, not a few of which still linger among us, and will linger, standing in the way of sounder views and a safer practice, till another generation sees the light. And among the men upon whose minds these shadows of old opinions thus still rest—who have begun to ascend, but have not yet escaped from the mists of the valley—from these men we hear the opinion sagely propounded—"Chemistry must be content to follow—she cannot lead in agriculture." But this is mere fudge; agriculture, above every other art, is accustomed to be led by theory. Every little farmer has his foolish fancies, which direct his practice; and it is only to be lamented, that while so willing to be led, she has been accustomed to listen more frequently to the voice of the mere empyric, than to that of the sound philosopher.

So far as we have seen, she was led by physiology, and into what difficulties;—let us now see what she has begun to think since chemistry took her by the hand, and began at once to teach and to guide her. The ash of plants was the first object of study. Little came of the early analyses of De Saussure. They were inaccurately performed, and it was well that no attempt was made to deduce any important natural consequence from them. But the resources of chemical skill increased, and better instructed men turned their attention to the subject. Sprengel we may mention as the most indefatigable in this line, and one who has mainly contributed to the establishment of the received views—though we may also add, that the highest analytical skill has never yet been enlisted in this cause. These analyses proved that the notion of the organic being the only essential part of the vegetable, could no longer be entertained; that earthy matter was also essential to the existence of the plant; and that in each species of plant, and even in each part of the same plant, the earthy matter was present in a quantity peculiar to itself, while the quantity or kind of matter of which the ash consisted, was also different in different plants, and generally special in each. Well, this being proved by chemistry, what followed from it? Why, that the old physiological doctrine about the essential nature of the vegetable matter, had only looked at the subject with one eye, that now the chemical doctrine opened the other eye, and the plant was then seen to consist of two essential parts—an organic and an inorganic part. But how did this affect practice? Why, thus—the old races of stimulants and fermentators, and all the rest of them were dismissed. The plant has an inorganic part which must be fed, and must grow by the aid of inorganic *food*—it must have mineral food as well as vegetable food. From this it further followed, that vegetable manures, if they make plants grow, do so, not because they supply organic food *only*, but because they contain, and are able to supply inorganic food also. And again, mineral substances made a plant grow, not by some hidden mode of merely stimulating it to take up and appropriate a larger portion of the vegetable matter which had been applied to its roots, but because it actually entered into its substance, and supplied that inorganic food which was not previously within reach of its roots.

Thus, in regard to the soil, it followed from the some doctrine, that mere vegetable matter might be increased to any amount, as by ploughing in green crops, &c., without its being possible to save the land from ultimate barrenness, if crops were continually carried off, and nothing—no mineral matter, that is—restored to it. Let the American farmers burn their straw, and top-dress their soil with the ash; and though they do not convert their straw into manure, as in our fold-yards, yet with the aid of their green clover, their land may retain its fertility for half a century longer, without the addition of foreign manures. Let the ash of the cane trash be used to top-dress the young canes, or be put in holes about their roots, crushing it first when it happens to be melted, and though past mismanagement may not be repaired, further exhaustion will proceed with infinitely greater slowness. We have a

word for our Indian empire too: Let the indigo planters return the refuse of their leaves, when their indigo is extracted, to the fields from which they were gathered, and we assure them from experience, that their lands will not fail them half so soon.

But further than this still the same chemical doctrine goes. It has been found that the ash of nearly all plants contains about *eleven* different incombustible substances, in greater or less quantity, all of which can be derived from the soil only. To produce a healthy vegetation, therefore, the soil must contain all these, and as the most valuable plants, those we raise for food, take up these substances in different proportions, some, for example, requiring more soda, others more potash or lime, it is clear that to grow any of these plants, the soil must contain an especial supply of that substance, which the species we select may happen to require. And so, when we sow our selected seed, we are safe so far in adding to the soil a portion of that substance, at the same time, by way of a manure; and safer still, if we have previously ascertained the soil to be deficient in that substance—while, on the other hand, if the soil be destitute of it, and we cannot obtain a supply, we need not sow our seed. If, for example, the soil contain gypsum, or sulphate of soda, or sulphate of magnesia, it will grow red clover; if it contains none of these, we need hardly sow our seed, unless we can add some sulphate or other along with it. The whole theory of mineral manures was first, we believe, systematically treated by Lampadius; it was subsequently expanded by Sprengel, in one of his valuable works: and though it has not yet generally diffused itself every where, it is rapidly assuming the direction of all agricultural improvements among ourselves, and the works now before us will serve an important purpose, in making generally known among practical men the nature and important practical bearing of the new chemical agriculture.

But the consequences of the same chemical doctrine, of the *essential* nature of the incombustible constituents of plants, lead us still further, to what appear more remote, yet are still necessary and very curious truths. The soil draws its supplies from the manure that is added to it—the plant takes them from the soil—the animal from the plants it feeds upon—and if it increase neither in size nor weight, it returns all the mineral matter to the soil again, in the form of manure. Here is a beautiful circle of natural operations, connecting together the living and the dead—the animate with the inanimate—the plant with the animal, in one common and mutual dependence. The theory, therefore, that throws new light upon one of these branches, will illuminate all. If the soil do not contain all that the plant requires, either the plant will die, or it will lead a sickly life. If the plants, again, on which it feeds be deficient in some one substance which is necessary to build up the various solid and fluid parts of the animal, it will also pine away, and sooner or later die. So that on the constitution of the soil is dependent the health and life of all the animals that are fed upon its produce; in other words, the same chemical doctrine extends its influence to the feeding of stock, and must in future (insensibly, it may be, but surely) modify all our notions regarding the feeding of animals, and direct to the wisest, safest, best, and most economical management on the part of the breeder and feeder of cattle, as well as of the arable farmer and grower of corn.

Space will not permit us to dwell longer on this subject, otherwise it would have been curious to follow the progress of opinion in regard to the uses of the soil; of what it ought to consist, and on what its fertility depends; from the time when, half a century ago, Ruckert gave forth the view, "that a soil must contain all the substances which are found in the decomposed plant, and that on the presence of these in the soil, its fertility must in some measure depend;" through those puerile times, during which the Berlin Academy gave a prize to one of its members for *proving* that these earthy and saline substances were actually formed in and by the plant; to the very recent period when Crome and Schubler again taught, that the fertility of a soil depended mainly on its physical properties. But there remain two or three other topics to which we are anxious still to advert, and we must, therefore, content ourselves with expressing our entire concurrence in the old doctrine of Ruckert, established, we may almost say, by the experimental researches of Lampadius and Sprengel, supported by the opinion of Liebig, and fully and practically brought out by the author of the works now before us.

The connexion of geology with agriculture, as we have already stated, was in some measure foreseen and touched upon by Davy. It has also attracted the attention of some of the German writers; but in so far as we know, it is not treated of in a systematic manner in any existing work, either English or foreign, with the exception of the lectures on agricultural geology now before us. There are considerable difficulties in the way of establishing a close connexion between the soils of a country and the rocks of which its surface is composed, though there can be no doubt that the general agricultural character of every extensive district is dependent upon that of the stratified or unstratified deposites on which the district rests. Thus after giving a detailed description of the nature of the soils formed from the stratified rocks of each geological period, and of the localities where such soils are seen in our islands, our author concludes with these observations—

"The consideration of the facts above stated shows how very much the fertility of each district is dependent upon its geological structure—how much a previous knowledge of that structure is fitted to enlighten us, in regard to the nature of the soils to be expected in any district—to explain anomalies also in regard to the unlike agricultural capabilities of soils apparently similar—to indicate to the purchaser where good or better lands are to be expected, and to the improver, whether the means of ameliorating his soil by liming by marling or by other judicious admixture, are likely to be within his reach, and in what direction they are to be sought for."

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It is an opinion universally entertained among practical men, that taking animal manures in general, any given weight of them is more valuable in promoting the growth of a crop, than an equal weight of the vegetable products on which the animal has been fed. This is true

not only of animal excretions, but of the various parts of animal bodies also. This superior effect is in part explained by the fact, that they are all richer in nitrogen, and during their decay, therefore, give off a larger quantity of ammonia than an equal weight of any vegetable substance employed for food. But how does the animal matter acquire this richness? We inhale oxygen, but no nitrogen, from the atmosphere—how, then, is the vegetable matter changed in passing through the animal? What, in short, is the effect of the digestive process upon our vegetable food? The mystery is thus simply explained:

"Animals have two necessary vital functions to perform—to breathe and to digest. Both are of equal importance to the health and general welfare of the animal. The digester (the stomach) receives the food, melts it down, extracts from it what is best suited to its purposes, and conveys it into the blood. The breathers (the lungs) sift the blood thus mixed up with the newly digested food, combine oxygen with it, and extract carbon—which carbon, in the form of carbonic acid, they discharge by the mouth and nostrils into the air.

"Such is a general description of these two great processes—their effect upon the food that remains in the body and has to be rejected from it, is not difficult to perceive.

"Suppose an animal to be full grown. Take a full grown man. All that he eats as food is intended merely to renovate or replenish his system, to restore that which is daily removed from every part of his body by natural causes. *In the full grown state, every thing that enters the body must come out of the body* in one form or another. The first part of the food that escapes is that portion of its carbon that passes off from the lungs during respiration. This portion varies in weight in different individuals—chiefly according to the quantity of exercise they take. From five to nine ounces a-day is the average quantity, though in periods of violent bodily exertion thirteen to fifteen ounces of carbon are breathed out in the form of carbonic acid.

"Suppose a man to eat a pound and a half of bread, and a pound of beef in twenty-four hours, and that he gives off by respiration eight ounces of carbon (3500 grains) during the same time. Then he has

	Carbon.	Nitrogen.
Taken, in his food, about	4500 grains,	and 500 grains, while
He has given off in respiration,	3500	and little or no nitrogen.
Leaving to be converted into food, or to be rejected	1000 grains	and 500 grains.

"Our two conclusions, therefore, are clear. The vegetable food, by respiration, is freed from a large portion of its carbon, which is discharged into the air—nearly the whole of the nitrogen remaining behind.

"It is out of this residue, rich in nitrogen, that the several parts of animal bodies are built up. Hence the reason why they can be formed from food poor in nitrogen, and yet be themselves rich in the same element.

"It is this same residue also, which after it has performed its functions within the body, is discharged again in the form of solid and liquid excretions. Hence the greater richness in nitrogen—the greater fertilizing power of the dung of animals, than of the food on which they live."—*Elements*, pp. 171, 172.

We here see how it is that the excretions of animals, and especially of full grown animals, should be richer in nitrogen than the vegetables on which they are fed; and the same reasoning applies to the inorganic matter originally contained in the vegetable food. As a whole, the food is greatly diminished in weight during digestion, but nearly all the nitrogen and the whole of the inorganic matter still remain in it, and therefore it must be proportionately more influential as a manure, in so far as its action depends upon either of these constituents.

Again, the study of the purposes served by the food of animals, while it shows what a truly nourishing vegetable food must contain, throws much light also on what must necessarily enter into the food of plants.

"Man, and all domestic animals, may be supported, may even be fattened upon vegetable food alone—vegetables, therefore, must contain all the substances which are necessary to build up the several parts of animal bodies, and to supply the waste attendant upon the performance of the necessary functions of animal life. Let us consider what these substances are, and in what quantities they must be supplied to the human body.

"1. *The food must supply carbon for respiration.*

"A man of sedentary habits, or whose occupation requires little bodily exertion, may respire about five ounces of carbon in twenty-four hours; one who takes moderate exercise, about eight ounces; and one who has to undergo violent bodily exertion, from twelve to fifteen ounces.

"If we take the mean quantity of eight ounces, then, to supply this alone, a man must eat eighteen ounces of starch or sugar every day. If he take it in the form of wheaten bread, he will require 1¾ lbs. of bread, if in the form of potatoes, about 7½ lbs. of raw potatoes, to supply the waste caused by his respiratory organs alone.

"When the habits are sedentary, five lbs. of potatoes may be sufficient, when violent and continued exercise is taken, twelve to fifteen lbs. may be too little. At the same time it must be observed, that where the supply is less, the quantity of carbonic acid given off will either be less also, or the deficiency will be supplied at the expense of the body itself. In either case the strength will be impaired, and fresh food will be required to recruit the exhausted frame.

"2. *The food must repair the daily waste of the muscular part of the body.*

"When the body is full grown, a portion from every part of it is daily abstracted by natural processes, and rejected either in the perspiration or in the solid and fluid excrements. This portion must be supplied by the food, or the strength

will diminish—the frame will gradually waste away."

Among the substances thus daily removed from the body, are portions of muscular fibre (fibrin), of the clot of the blood, of gelatine, &c., all of which contain nitrogen, and must be replaced by the gluten of wheat flour, by the fibrin of lean meat, by the white of eggs, (albumen,) by the curd of cheese, (cassein,) or by some similar substance in the food.

"The quantity of one or other of these removed from the body in twenty-four hours, either in the perspiration or in the excretions, amounts to *about five ounces*, containing 350 grains of nitrogen, and this waste *at least* must be made up by the gluten or fibrin of the food.

"In the 1¾ lbs. of wheaten bread we have supposed to be eaten to supply carbon for respiration, there will be contained also about three ounces of gluten. Let the other two ounces be made up in beef, of which half a pound contains two ounces of dry fibrin, and we have

	For respiration.		For waste of muscle, &c.
1¾ lbs. of bread yielding,	18 oz. starch	and	3 oz. of gluten.
8 oz. of beef yielding, - - - - - - - -			2 oz. of fibrin.
Total consumed by respiration, and the ordinary waste, - -	18 oz. starch	and	5 oz. of gluten or fibrin.

"If, again, the 7½ lbs. of potatoes be eaten, then in these are contained about 2½ ounces of gluten or albumen, so that there remain 2½ ounces to be supplied by beef, eggs, milk, or cheese.

The reader, therefore, will understand why a diet which will keep up the human strength is easiest compounded of a mixture of vegetable and animal food. It is not merely that such a mixture is more agreeable to the palate, or even that it is absolutely necessary—for, as already observed, the strength may be fully maintained by vegetable food alone; it is because without animal food in one form or another, so large a bulk of vegetable food must be consumed in order to supply the requisite quantity of nitrogen in the form of gluten. Of ordinary wheaten bread alone, about three pounds daily must be eaten to supply the nitrogen, and there would then be a considerable waste of carbon in the form of starch, by which the stomach would be overloaded, and which, not being worked up by respiration, would pass off in the excretions. The wants of the body would be equally supplied, and with more ease, by 1¾ lbs. of bread, and 4 ounces of cheese.

"Of rice, again, no less than four pounds daily would be required to impart to the system the required proportion of gluten; and it is a familiar observation of those who have been in India, and other countries where rice is the usual food of the people, that the degree to which the natives distend, and apparently overload their stomachs with this grain, is quite extraordinary.

"The stomachs and other digestive apparatus of our domestic animals are of larger dimensions, and they are able, therefore, to contain with ease as much vegetable food, of almost any wholesome variety, as will supply them with the quantity of nitrogen they may require. Yet every feeder of stock knows that the addition of a small portion of oil-cake, a substance rich in nitrogen, will not only fatten an animal more speedily, but will also save a large *bulk* of other kinds of food."

Another purpose served by the food, in regard to which we have not space to quote the words of our author, is to supply the earthy and saline substances contained in the solids and fluids of the body. Of the earthy matter in the bones, and of the saline matter in the blood and in other fluids, a portion is every day rejected, a new portion must therefore every day be introduced into the body with the food, or the animal pines away and dies. This brings us back again to what we have formerly stated, that the soil must contain these substances as essential constituents—since they are so essential to the vegetable tribes that these latter could not fulfil their great purpose in the economy of nature—that of feeding the animal race—if they did not contain them. This reasoning backwards from the wants of animals, had we no other arguments on the subject, were alone sufficient to explode the absurdities of the accidental or non-essential nature of the inorganic part of vegetables, and of the fertility of soils being mainly dependent upon their physical properties. In short, one leading chemical idea pervades the entire field of theoretical agriculture—explains almost every important step which is taken by the enlightened practical farmer—and points the way to those further, and, we trust, large advances which the art of culture is yet destined to make, since the accelerated march of sound opinions is bringing under their influence a daily increasing number of the most intelligent farmers of the country.

CATERPILLARS ON THE ELMS.—HESSIAN FLY.

From Harris' Report on the Insects of Massachusetts.

Among the numerous insects that infest our noble elms, the largest is a kind of sphinx, which, from the four short horns on the fore part of the back, I have named *Ceratomia quadricornis*, or four-horned ceratomia. On some trees these sphinges exist in great numbers, and their ravages then become very obvious; while a few, though capable of doing considerable injury, may escape notice among the thick foliage which constitutes their food, or will only be betrayed by the copious and regularly formed pellets of excrement beneath the trees. They are very abundant during the months of July and August, on the large elms which surround the northern and eastern sides of the Common in Boston; and towards the end of August, when they descend from the trees for the purpose of going into the ground, they may often be seen crawling in the mall in considerable numbers. These caterpillars, at this period of their existence, are about three inches and a half in length, are of a pale green color, with seven oblique white lines on each side of the body, and a row of little notches, like saw-teeth, on the back. The four short horns on their shoulders are also

notched, and like most other Sphinges, they have a long and stiff spine on the hinder extremity of the body. They enter the earth to become chrysalids and pass the winter, and come forth in the winged state in the month of June following, at which time the moths may often be found on the trunks of trees, or on fences in the vicinity. In this state their wings expand nearly five inches, are of a light brown color, variegated with dark brown and white, and the hinder part of the body is marked with five longitudinal dark brown lines. A young friend of mine, in Boston, captured on the trunks of the trees a large number of these moths during a morning's walk in the mall, the past summer, although obliged to be on the alert to escape from the guardians of the common, whose duty it was to prevent the grass from being trodden down. Nearly all of these specimens were females, ready to deposite their eggs, with which their large bodies were completely filled. On being taken, they made scarcely any efforts to escape, and were safely carried away. It would not be difficult, by such means, very considerably to reduce the number of these destructive insects; in addition to which it might be expedient, during the proper season, for our city authorities to employ persons to gather and kill every morning the caterpillars which may be found in those public walks where they abound.

Grape-vine caterpillars.—From the genus Sphinx I have separated another group, to which I have given the name of *Philampelus*,* from the circumstance that the larvæ or caterpillars live upon the grape-vine. When young they have a long and slender tail recurved over the back like that of a dog; but this, after one or two changes of the skin, disappears, and nothing remains of it but a smooth, eye-like, raised spot on the top of the last segment of the body. Some of these caterpillars are pale green and others are brown, and the sides of their body are ornamented by six cream-colored spots, of a broad oval shape, in the species which produces the *Satellitia* of Linnæus, narrow oval and scalloped, in that which is transformed to the species called *Achemon* by Drury. They have the power of withdrawing the head and the first three segments of the body within the fourth segment, which gives them a short and blunt appearance when at rest. As they attain to the length of three inches or more, and are thick in proportion, they consume great quantities of leaves; and the long leafless branches of the vine too often afford evidence of their voracity. They also devour the leaves of the common creeper (*Ampelopsis quinquefolia*) which with those of our indigenous vines, were their only food till the introduction and increased cultivation of foreign vines afforded them an additional supply. They come to their growth during the month of August, enter the earth to transform, and appear in the winged or moth state the following summer in June and July. The *Satellitia* Hawk-moth expands from four to five inches, is of a light olive color, variegated with patches of darker olive. The *Achemon* expands from three to four inches, is of a reddish ash-color, with two triangular patches of deep brown on the thorax, and two square ones on each fore wing; the hind wings are pink, with a deeper red spot near the middle, and a broad ash-colored border behind.

The grape-vine suffers still more severely from the ravages of another kind of Sphinx caterpillars, smaller in size than the preceding, and like them solitary in their habits, but more numerous, and, not content with eating the leaves alone, in their progress from leaf to leaf down the stem, they stop at every cluster of fruit, and, either from stupidity or disappointment, nip off the stalks of the half-grown grapes, and allow them to fall to the ground untasted. I have gathered under a single vine above a quart of unripe grapes thus detached during one night by these caterpillars. They are naked and fleshy like those of the *Achemon*, and *Satellitia*, and are generally of a pale green color, (sometimes, however, brown,) with a row of orange colored spots on the top of the back, six or seven oblique darker green or brown lines on each side, and a short spine or horn on the hinder extremity. The head is very small, and, with the fore part of the body, is somewhat retractile, but not so completely as in the two preceding species. The fourth and fifth segments being very large and swollen, while the three anterior segments taper abruptly to the head, the fore part of the body presents a resemblance to the head and snout of a hog. This suggested the generical name of *Chærocampa*, or hog caterpillar, which has been applied to some of these insects. The species under consideration is found on the vine and the creeper in July and August; when full grown it descends to the ground, conceals itself under fallen leaves, which it draws together by a few threads so as to form a kind of cocoon, or covers itself with grains of earth and rubbish in the same way, and under this imperfect cover it changes to a pupa or chrysalis, and finally appears in the winged state in the month of July of the following year. The moth, to which Sir James Edward Smith gave the name of *Pampinatrix*, from its living on the shoots of the vine, expands from two and a half to three inches, is of an olive gray color, except the hind wings, which are rust-colored, and the fore wings and shoulder-covers are traversed with olive-green bands.

Hessian fly.—The far-famed Hessian fly, and the wheat fly of Europe, and of this country, are small gnats or midges, and belong to the family called *Cecidomyiadæ*, or gall gnats. The insects of this family are very numerous, and most of them, in the maggot state, live in galls or unnatural enlargements of the stems, leaves and buds of plants, caused by the punctures of the winged insects in laying their eggs. The Hessian fly, wheat fly, and some others differ from the majority in not producing such alterations in plants. The proboscis of these insects is very short, and does not contain the piercing bristles found in the long proboscis of the biting gnats and mosquitoes. Their antennæ are long, composed of many little, bead-like joints, which are larger in the males than in the other sex; and each joint is surrounded with short hairs.

Their eyes are kidney-shaped. Their legs are rather long and very slender. Their wings have only two, three, or four veins in them, and are fringed with little hairs around the edges; when not in use, they are generally carried flat on the back. The hind body of the females often ends with a retractile, conical tube, wherewith they de-

* The literal signification of this word is, *I love the vine.*

posite their eggs. Their young are little footless maggots, tapering at each end, and generally of a deep yellow or orange color. They live on the juices of plants, and undergo their transformations either in these plants or in the ground.

The Hessian fly was scientifically described by Mr. Say, in 1817, under the name of *Cecidomyia destructor*. It obtained its common name from a supposition that it was brought to this country in some straw, by the Hessian troops under the command of Sir William Howe, in the war of the Revolution. This supposition, however, has been thought to be erroneous, because the early inquiries made to discover the Hessian fly in Germany were unsuccessful; and, in consequence thereof, Sir Joseph Banks, in this report to the British government, in 1789, stated that "no such insect could be found to exist in Germany or any other part of Europe." It appears, however, that the same insect, or one exactly like it in habits, had been long known in Europe; an account of it may be found in Duhamel's "Practical Treatise of Husbandry," and in a communication made to the Duke of Dorset, in 1788, by the Royal Society of Agriculture of France. In the year 1833, the wheat in Hungary was considerably injured by an insect of the same kind, supposed to be the Hessian fly by the Baron Kollar. Moreover, Mr E. C. Herrick, of New Haven, Connecticut, has recently published an account of this discovery of the true Hessian fly, by Mr James D. Dana, in Minorca, near Toulon in France, and in the vicinity of Naples. Nothing has yet been found relative to the existence of the Hessian fly in America before the Revolution. It was first discovered in the year 1776, in the neighborhood of Sir William Howe's debarkation on Staten Island, and at Flat Bush, on the west end of Long Island. Having multiplied in these places, the insects gradually spread over the southern parts of New York and Connecticut, and continued to proceed inland at the rate of fifteen or twenty miles a-year. They reached Saratoga, two hundred miles from their original station, in 1789. Dr. Chapman says that they were found west of the Alleghany mountains in 1797; from their progress through the country, having apparently advanced about thirty miles every summer. Wheat, rye, barley and even timothy grass were attacked by them; and so great were their ravages in the larva state, that the cultivation of wheat was abandoned in many places where they had established themselves. In a communication by Mr. J. W. Jeffreys, published in the sixth volume of Buel's Cultivator, it is stated, that soon after the battle of Guildford, in North Carolina, the wheat crops were destroyed by the Hessian fly in Orange county, through which the British army, composed in part of Hessian soldiers, had previously passed. Although it is possible that, in this instance, the chinch bug may have been mistaken for the Hessian fly, the remark shows how prevalent was the belief respecting the introduction of the latter. The foregoing statements, taken in connexion with the habits of the Hessian fly, induce me to think that the common opinion relative to its origin is deserving of some credit, although we are as yet without any positive evidence of the existence of this insect in Germany.

The following brief history of the habits and transformations of the Hessian fly will be found to agree essentially with the excellent observations on this insect, written in the year 1797, by Dr. Isaac Chapman, and published in the fifth volume of the "Memoirs of the Philadelphia Society for promoting Agriculture." Mr. Herrick has kindly permitted me to make free use of his valuable account of this insect, contained in the forty-first volume of "The American Journal of Science," and of other information communicated by him to me in various letters. The latter gentleman has spent some time in carefully observing the habits of the fly, during many years in succession; and, having fitted himself for the task by the study of the natural history of insects in general, his statements may be implicitly relied upon. Moreover, they are corroborated by the observations of many other persons, published in various works, which I have consulted in the course of my investigations. Nor have I neglected to examine every thing on this insect that has fallen under my notice, and shall hereafter allude to some of the contradictory statements that have been published relative to certain parts of its economy.

The head and thorax of this fly are black. The hind body is tawny, and covered with fine grayish hairs. The wings are blackish, but are more or less tinged with yellow at the base, where also they are very narrow; they are fringed with short hairs, and are rounded at the end. The body measures about one-tenth of an inch in length, and the wings expand one quarter of an inch, or more. It is a true *Cecidomyia*, differing from *Lasioptera* in the shortness of the first joint of its feet, and in the greater length of its antennæ, the bead-like swellings whereof are also more distant from each other. Two broods or generations are brought to maturity in the course of a year, and the flies appear in the spring and autumn, but rather earlier in the southern and middle states than in New England. The transformations of some in each brood appear to be retarded beyond the usual time, as is found to be the case with many other insects; so that the life of these individuals, from the egg to the winged state, extends to a year or more in length, whereby the continuation of the species in after years is made more sure. It has frequently been asserted that the flies lay their eggs on the grain in the ear; but whether this be true or not, it is certain that they do lay their eggs on the young plants, and long before the grain is ripe; for many persons have witnessed and testified to this fact. In the New England states, winter wheat, as it is called, is usually sown about the first of September. Towards the end of this month, and in October, when the grain has sprouted, and begins to show a leaf or two, the flies appear in the fields, and, having paired, begin to lay their eggs, in which business they are occupied for several weeks. The following interesting account of the manner in which this is done was written by Mr. Edward Tilghman, of Queen Ann county, Maryland, and was published in the eighth volume of the Cultivator, in May, 1841. "By the second week of October, the first sown wheat being well up, and having generally put forth its second and third blades, I resorted to my field in a fine warm forenoon, to endeavor to satisfy myself by ocular demonstration, whether the fly did deposite the egg on the blades of the growing plant. Selecting a favorable spot to make my observation, I placed myself in a re-

clining position in a furrow, and had been on the watch but a minute or two, before I discovered a number of small black flies alighting and sitting on the wheat plants around me, and presently one settled on the ridged surface of a blade of a plant, completely within my reach and distinct observation. She immediately began depositing her eggs in the longitudinal cavity between the little ridges of the blade. I could distinctly see the eggs ejected from a kind of tube or sting. After she had deposited eight or ten eggs, I easily caught her upon the blade, and wrapped her up in a piece of paper. I then proceeded to take up the plant, with as much as I conveniently could of the circumjacent earth, and wrapped it all securely in a piece of paper. After that I continued my observations on the flies, caught several similarly occupied, and could see the eggs uniformly placed in the longitudinal cavities of the blades of the wheat; their appearance being that of minute reddish specks. My own mind being thus completely and fully satisfied as to the mode in which the egg was deposited, I proceeded directly to my dwelling, and put the plant with the eggs upon it, in a large glass tumbler, adding a little water to the earth, and secured the vessel by covering it with paper so that no insect could get access to the interior. The paper was sufficiently perforated with pin holes for the admission of air. The tumbler with its contents was daily watched by myself to discover the hatching of the eggs. About the middle of the fifteenth day from the deposite of the eggs, I was so fortunate as to discover a very small maggot or worm, of a reddish cast, making its way with considerable activity down the blade, and saw it till it disappeared between the blade and stem of the plant. This, I have no doubt, was the produce of one of the eggs, and would, I presume, have hatched much sooner, had the plant remained in the field. It was my intention to have carried on the experiment, by endeavoring to hatch out the insect from the flax-seed state into the perfect fly again; but being called from home, the plant was suffered to perish. The fly that I caught on the blade of the wheat, as above stated, I enclosed in a letter to Mr. John S. Skinner, the editor of the "American Farmer," of Baltimore, who pronounced it to be a genuine Hessian fly, and identical in appearance with others recently received from Virginia."

The best modes of preventing the ravages of the Hessian fly are thus stated by Mr. Herrick:—"The stouter varieties of wheat ought always to be chosen, and the land should be kept in good condition. If fall wheat is sown late, some of the eggs will be avoided, but risk of winter-killing the plants will be incurred. If cattle are permitted to graze the wheat fields during the fall, they will devour many of the eggs. A large number of the pupæ may be destroyed by burning the wheat stubble immediately after harvest, and then plowing and harrowing the land. This method will undoubtedly do much good. As the Hessian fly also lays its eggs, to some extent, on rye and barley, these crops should be treated in a similar manner."

CANADA THISTLES.

From the New Genesee Farmer.

This communication deserves particular attention.

Mr. Henry Colman—An allusion appears to be made in the May number of the New Genesee Farmer, to a conversation with you when you were in this place, some little time since, relative to the destruction of that pest, the Canada thistle.

The way of doing it, which is both sure and certain and attended with but little expense, would be profitably expended in any land infested with any foul weeds or worn down by shallow ploughings. All the foul seeds in the ground would sprout and be destroyed and the ground be left in first rate order for wheat, or almost any other crop: and if the ploughings could be made twelve inches deep, the wheat would not be much liable to get winter killed. And if the same amount of green vegetation could be ploughed under that would be in the thistle patches, the good effects thereof would be lasting, as much so, or more, than a heavy coat of manure. In a visit to my brother Aaron, then living in South Le Roy, in 1841, but now Pavilion, I noticed that the wheat on a part of his field was twice as large as on other parts. I inquired of him how it happened that there was such a difference in his wheat. O! says he, that is where my old thistle bed was six years ago, that the wheat is so stout. I can feel the difference where the thistles were the moment the plough strikes it; the land is more mellow, and the plough inclined to go deeper than in any other parts of the field. The way I took to destroy them, says he, I commenced ploughing them about the first of June, in the most careful and thorough manner, taking special care that not a single thistle root should escape the plough. A month from that time I ploughed again in the same careful manner,—and in another month I ploughed again; the fourth month I ploughed it again, making four ploughings, not harrowing it at all, that it should be left in the same order at each time as the plough left it, excepting the last time, when it was in high order for the sowing of wheat. Not a particle of any foul weed appeared upon it, and I got as fine a crop of wheat as I ever had on any lands, and not a single particle of a thistle could be found among the wheat when I harvested it.

I have not the least doubt if any person troubled with thistles, or any other foul weeds, will follow the method here laid down, in as thorough a manner as my brother did, they would be utterly and completely destroyed.

Thus it may be seen that the entire destruction of the pest costs nothing; it is merely a superior method of preparing the land for a crop of wheat, and that the extra expense will be found to be more than compensated by an extra crop of wheat and the finer tilth in which the land will be left, when the wheat is taken from it, over that managed in the common way.

I am, respectfully, your friend, &c.

THOMAS TUFTS.

Le Roy, June 9th, 1842.

GREAT DISMAL SWAMP.

Extract from Lyell's Lectures.

Many of you, I suppose, have seen the morass called the Great Dismal, in North Carolina and Virginia: and you have probably had an opportunity, as I have, of crossing the northern extremity of it on a railway supported by piles from Norfolk to Weldon. This is no less than forty miles from north to south, and twenty from east to west covered entirely with various forest trees, under which is a great quantity of moss; the vegetation is of every variety of size from common creeping moss to tall cypresses 130 feet high. The water surrounds the roots of these trees for many months in the year. And this is a most singular fact to one who has travelled only in Europe, that, as is the case in the United States, trees should grow in the water, or surrounded to a certain height by water, and yet not be killed. This Great Dismal was explored some years since by Mr. Edmund Ruffin, author of a valuable agricultural journal. He first calls attention to the fact that a greater portion of the vast morass stands higher than the ground that surrounds it; it is a great spongy mass of peat, standing some seven or eight feet higher than its banks, as was ascertained by careful measurements when the railroad was cut through. It consists of vegetable matter with a slight admixture of earthy substance, as in coal. The source of peat in Scotland is that one layer of vegetation is not decomposed before another forms. So it is in Chili, Patagonia, and Terra del Fuego. Thus also is it in different parts of Europe, in the Falkland Islands, as Darwin has shown. Thus, too, is it in the Great Dismal, where the plants and trees are different from those of the peat in New York. It is found on cutting down the trees and draining the swamp and letting in the sun, that the vegetation will not be supported as it was before beneath the dark shades of the trees. In the middle is a fine lake, and the whole is inhabited by wild animals, and it is somewhat dangerous to dwell near it by reason of the bad atmosphere it creates. It is covered by most luxuriant vegetation. We find in some places in England that there is a species of walking mosses which are sometimes seized with a fancy to walk off from their places: the moss swells up, bursts and rolls off, sometimes burying cottages in its path. In some places this peat has been dug into and houses have been found several feet below the surface—curious antiquarian remains. In the same manner the Great Dismal may spread itself over the surrounding country.

HANDLING COTTON.

Extract from the Southern (Miss.) Planter.

As you say, the subject of cotton but too readily suggests itself to the mind of every southerner—and while we may flatter ourselves at having arrived to some degree of perfection in the cultivation of the growing plant, there is one point we must all acknowledge has been too much neglected by our planters. I allude to the *handling* of cotton after it is made or gathered from the fields. The article advises the system of *throwing cotton into large piles in our gins* so soon as picked, in order to undergo the process of *heating*. It contends that it diffuses the oil of the seed into the lint, thereby producing a richer color and more substantial fibre. This is an important point in the *handling* of cotton, and the views of the writer are so different from my own that I cannot refrain from offering you some objections to it. I regard this system as, unfortunately for our own interests, but too much in practice at present. The low condition of our cotton market, at the present time particularly, calls for a reformation among our planters, and urges upon them the necessity of sending our crops for sale in a better condition. Much can be said upon this subject—too much is required, for me to attempt it at present, and I shall content myself merely by stating my views in relation to the system above alluded to.

I do not think, then, that the color of cotton is improved by *heating*, but it is a serious injury in many respects. It is true some becomes more yellow—whilst some assumes a bluish cast, consequently not uniform—and even that which does become more yellow, does not present the bright lively color so much desired. We all know that there is more or less dirt or dust in cotton when brought from the fields—by heating, this dirt stains the cotton, or rather causes it to assume a dingy, dull appearance, in contrast with the natural, lively, bright, cream color, which it exhibits when dried upon the scaffolds. The fibre, too, is injured—loses its elasticity and strength—becomes dead and heavy in appearance. I admit that it gins more easily, but is that not an evidence of loss of strength? I contend, too, that the sun, when it is exposed upon the scaffolds, will draw the oil from the seed, dissipate the water and diffuse the oil into the fibre, much better than can be accomplished by heat from moisture—the dust will be shaken out, or if not, will become so dry as not to injure the cotton before it reaches the gin stand, where it will be, or *should be*, entirely separated. Cotton which has been heated in piles will gin easier and faster, but not so well—will be torn off from the seed in large flakes which cannot be separated by the brush, each fibre to itself, which causes it to present that carded appearance which attracts the fancy of the buyer. These are my simple reasons for believing that a thorough course of drying upon scaffolds in the sun is the better plan, and the only practical plan of producing a perfect article for market. By the one process we obtain an irregular yellow color, dull, lifeless, dingy cotton—by the other, a rich, lively, bright cream-color, with more elasticity, as is plainly discovered at the press, by those who have tried it. The writer above alluded to is also deceived in another fact. He assigns, as a reason that the sun destroys the color of cotton, the fact, that cotton picked immediately after opening has the richest color. This is true—and it loses its color by exposure to the *dews*, and not to the sun. So, also, cotton picked early in the season has a richer color than that picked late, and that is owning to the sun having more power—dissipating the moisture before it has time to bleach the cotton.

These reflections I have hastily thrown together—and they are now at your disposal—should you deem them worthy of insertion in the Southern Planter, I may from time to time give you my

views in relation to other points in the *system of handling cotton.* Very respectfully yours, &c.

HALLER NUTT.

Laurel Hill, Jefferson county, April 22, 1842.

REJOINDER ON THE DOCTRINE OF ROTATION OF CROPS.

For the Farmers' Register, (in lieu of No. 6.)

Before the receipt of the last Register I had been casting in my mind on what subject I should prepare another number. I am now more than relieved; for, instead of no subject at all, I have too much subject. I was once sitting at the table of a friend, at which a Frenchman was also a guest. Seeing the hospitable hostess loading his plate with more food than he could devour, in all the feverish eagerness of his country, he exclaimed, "plenty, plenty, madame, too monsh plenty." In the same manner, when I opened the last Register, and found myself assailed, not by *one* formidable opponent alone, but by *two*, and one of these the veteran editor himself, I could but think of my Frenchman, and with him exclaim, plenty, plenty, gentlemen, too much plenty.

When I wrote my little unpretending piece on rotation of crops, (I really intended it should be a *modest*, not a "Le Noir Faineant" affair,) I was aware that some of the sentiments therein contained would be regarded as novel, and therefore would probably call forth the strictures of some who were wedded to their own peculiar notions on this subject. In anticipation, then, of such an event, I thought I had prepared the way for mercy, by "bespeaking their kindness, and that if they thought proper to inflict upon me a castigation, it might be as moderate and gentle as possible." Like King David, when his son was in rebellion against him, I stood in the gate and earnestly entreated my assailants as they came forth to "deal *gently* with the young man Absalom." But how does the matter stand? Notwithstanding my earnest entreaty, first, "Wm. M. Peyton, of Big Lick, Roanoke county," (there are men of extraordinary size in that country, and I suspect Mr. Peyton is a giant,) falls foul of me in the most merciless manner; and then the editor coming up, (he too is a *great* man,) and finding a few places which were not already beaten to a mummy, attacks these few; and thus both together leave me, supposing me to be dead outright. Having obtained so signal a victory, as they supposed, they were in too great haste to celebrate it; and it is owing to this imprudence that I have escaped with my life. The *amount* of the injury is, that in this unequal contest I was very much bruised; some of the blows were so severe as to stun me for the moment; but now I have pretty well recovered from my fright, and I am happy to say that my wounds are in a state of rapid convalescence; so that—boasting aside—I am again prepared to meet my adversaries, one or both, just as they please. But I greatly prefer one at a time, if you please, gentlemen. In ordinary cases I consider all artifice as absolutely inexcusable; but, in times of war, I believe it is considered, even by the most polite nations, and by the most accomplished generals, as perfectly consistent with the laws of honor, to resort to their "*ruses de guerre.*" No one ever yet considered it as dishonorable in the one surviving Horatius, to *feign* a retreat when sorely pressed by the *three* Curatii. In the same manner, assailed as I am by *two* formidable adversaries at once, each of whom is amply sufficient for any *one* man, I hope I shall be permitted to separate them. On the other hand, as the *challenged* party, I have a *right* to dictate the terms of contest. I say then to the editor, Stand aloof—restrain your ardors for the fight—I will not even allow you to shout "*hurra!*" whilst your associate and I are in the conflict. If I escape alive, I hereby promise to pay my respects to you. I also give you notice that, in this contest, it may suit my purpose to give *you* an occasional "side wipe" or "back-handed blow," but even in that event, you are not to return the compliment, but still keep cool at your respectful distance.

There is also another preliminary on which I shall insist, and that is, that Mr. Peyton shall also come single-handed; at least he must leave De Candolle, Macaire Princep, and every other Frenchman, behind him. If my adversary is acquainted with these gentlemen, and has enlisted them in his service, then he has an advantage over me which I am by no means disposed to yield. For my part, I know almost nothing of them except what Liebig has told me, and from his account, I feel no great solicitude to cultivate much further acquaintance with them. If, however, Chaptal, Sir H. Davy, Liebig, Buel, Webster and Dana can be of any service to him, he may bring them. But to the Frenchmen I positively object; for they are almost utter strangers to me.

One other preliminary settled, and the gentleman and I will be prepared for the matter in hand, and that is, that he shall not be so nice and critical in his distinctions. He may employ his Latin words as much as he pleases; but what I particularly insist on is, that he will allow me to use the *common* words, *fertility* and *manure*, in my own way, and that he will not confuse them by nice distinctions, showing wherein they differ from humus, geine, or ammonia. In the piece commented on, it was not my object to inquire if the word *fertility* implied more or less than these terms; but simply to state that the learned men whose names I mentioned ascribed the fertility of a soil to the presence of one or other of these ingredients.

Having settled these preliminaries, I will at once proceed to the matter in controversy. And what is it? Mr. Peyton and the editor seem both to have fallen into a mistake on this point. This makes it necessary that I should more particularly "define my position." Both of these gentlemen go upon the suppotition that I am opposed to rotations of *every kind*, and under *every circumstance.* This I plainly and positively deny; nor is this inference fairly deducible from any part of my published piece. I hesitate not to avow that I am opposed to rotations for the common, and, as I think, *universal* purposes for which they are resorted to. And what are these? To *increase* a fertility which already exists, or at least to maintain it, or, in other words, to make the subsequent crop *greater* than the preceding, or at least equal to it. Hence it is, that in nearly or quite all the treatises I have seen on this subject, of which there have been a great many in the Farmers' Register, the

writer almost invariably concludes in language to this effect—that, "under this system, my land is constantly improving." Indeed, I can conceive of no valuable purpose which can possibly be answered by a rotation, unless it be one or the other of those stated above. Now the position which I take at this time, and which I took in my published piece, is that all crops, grain, grass, and of every other kind, *when removed from the soil*, are exhausters, some to a greater and others to a less extent, but generally in proportion to the amount removed. This position I regard as almost self-evident. If there be any axiom in agriculture, I think this ought to be one. For what is it that has wasted away the fertility of our lands, until in many instances it is almost totally destroyed? Is it not that constant and injudicious *cropping* to which they have been subjected—taking off every thing that we could lay hands on, and supplying nothing in return? Here, then, is an evil inflicted upon the land, and it is *cropping* that has done it. Now can it be conceived that *subsequent* cropping will repair the injury of *previous* cropping? I will believe this when I can prevail on myself to think that the right way to repair a theft is to go and steal more. Or, as in this present controversy, Mr. Peyton gives me a drubbing, and, by way of soothing my pains, and thus repairing the injury, the editor steps forward and gives me a more severe one. "*Noli me tangere*"—here is Latin, but I will translate it—"hands off, if you please." This, then, is one respect in which I am utterly opposed to all rotations; and I must remain in the same ruind until the ingenuity of these or other shrewd farmers can convince me that one injury can be repaired by another. "*Judæus Apella credat, non ego.*" This Latin is a little harder than the other; I therefore leave it to *Mr. Peyton* to translate. I am also utterly opposed to rotations on the score that there are in the soil certain ingredients which may be so taken up by any one crop as to leave the soil in a state unfit to reproduce that same crop. If there be any exception to this, it is perhaps a crop of flax. But Mr. Peyton tells us "that a single swallow does not make a summer." Here then is proof *positive*, that absolute reliance cannot be placed upon a single exception; or if this proof is not already strong enough, "my Lord Coke" will help it out. But when I speak of a soil, I of course mean a *fertile* one; for a poor exhausted soil will produce no crop of any kind. This, if I understand him, is the main ground on which Mr. Peyton relies in his plea for rotations. In support of it, he states it as a notorious fact, that lands in his section of country, when so exhausted that they will not produce *grain* enough to pay for the cultivation, will nevertheless produce large crops of *clover*. Old tobacco lots also are restored in the same way. Liebig also helps him out with a case in which some one near Gö tingen, (a great way off,) by raising a crop of wormwood, so exhausted the soil of its potash, that "it refused to bear grass for many years." Now, here is a hard case, Mr. Peyton, Liebig, the Göttingen farmer, and, what is much harder still, *facts* against me. And what shall I do with it? I will try to dispose of the *facts*, and if I succeed in this, I will leave Mr. Peyton, Liebig and the Göttingen man to dispose of themselves.

The first fact is that lands near the Big Lick, in Roanoke county, (mark the position,) when they refuse to produce grain, having, as I suppose, parted from all the peculiar ingredients fitted for that crop, will nevertheless produce large crops of *clover*. Now, although my present location is so near a city that I snuff the smoke of it every time the wind sets strong from that quarter, yet I happened to be born and reared to a large youth in a county adjoining the one which numbers Mr. Peyton among its citizens, and therefore I know "a thing or two" about these very lands. It is true that I do not know the *particular farm* which Mr. Peyton occupies; nor have I the pleasure of knowing that gentleman himself, but I speak of the general character of the lands in that neighborhood; and I do know that they were originally exuberantly rich. They are a part of those "valley lands," which have a limestone foundation for their substratum; lands, as is proved in Kentucky and Pennsylvania, peculiarly adapted to the grasses, and to the growth of clover in particular. I have even seen clover growing luxuriantly in the woods on those lands. Indeed clover, although one of the artificial grasses, seems almost indigenous to that soil. It really seems almost as natural for clover to grow *there*, as for crab-grass to grow *here*. Now, in a soil naturally rich, and at the same time naturally disposed to produce clover, I am not surprised that it should grow, and grow vigorously, on a soil which refuses to produce an article to which it is not so congenial. The old worn-out tobacco lots are recruited, I presume, in the same way, and on the same principle. And as to Liebig's Göttingen farm, (I wish it was near enough for me to visit it,) it proves just nothing at all, or, if possible, *less* than nothing. It seems that a man, in his eagerness "to obtain potash, planted his whole farm with wormwood." Whether he got a crop or not, we are not told, and we are not told a great many other things which, in a matter of authority, I should like to know; but I presume he did get one, for he so ruined his land that it refused to bear grass for several years. Refused to bear *what?* We are to'd *grass*. But grass was not the last crop that it produced! When I came to this, I thought that Mr. Peyton must have made a mistake in his quotation, or that the *printer* must have made one. But no! All is right. Liebig says that, after producing the wormwood, the land refused to bear *grass*. Now why a rotationist should refer to this as authority, I cannot conceive. *Wormwood*, surely, is not the same thing as *grass*. In *appearance* they are very different, and in *taste* still more so. Why, then, should the *wormwood* incapacitate the land to bear *grass*, a thing so different from itself? But it seems that the potash was so taken up by the wormwood, that none was left for the grass. Potash, then, cannot be one of the *peculiar* ingredients which is necessary to one crop and not to another. Here it was necessary to at least *two* crops, and, for aught I know, equally necessary to twenty crops besides. And so it falls in with my theory, that the same ingredient, which I have taken the liberty of calling *fertility*, is just as necessary to one crop as to another. With this statement, I am at no loss to account for the failure in the man's grass crops. The wormwood exhausted the lands not only of their potash, but of their *fertility*, a thing which in my estimation is

of much more importance. If the man, instead of puzzling his brains about the deficiency of potash, had only gone to Liebig and got some of his ammonia, and applied it pretty liberally, I doubt not his farm would have produced heavier and better crops of grass than they ever did before. Give me therefore this one peculiar ingredient, *fertility*, and I care not a fig for all the other peculiar ingredients put together.

But I have a little more to say about this Göttingen farmer, so much relied upon as authority by your correspondent, Mr. Peyton. According to Liebig's account of him—and this is all I know—I suspect that he was but a very poor farmer after all. He risked the productions of a whole year upon a *single* crop! Now I never knew even a *gambler*, rash and fool-hardy as gamblers commonly are, to risk his whole stake upon the cast of a single die. I wish the man had tried wormwood a second time, when he failed in grass. But I suppose that Liebig had drilled him too well in the doctrines of rotation, for this.

There is another reason why I am opposed to this peculiar ingredient system; and that is, that, in my present circumstances, I should find it too expensive and too troublesome to practise upon. On this plan, as I am not a chemist, I should have to employ one; and as Liebig stands higher in authority than any other man, I think I should prefer him. I could get Macaire Princep, or De Candolle, or some other Frenchman, perhaps, a little cheaper; but still, for certain reasons, I think I should prefer Liebig. Now although, as I have had occasion to state elsewhere, the income of my farm is pretty considerable, still I fear that the increased income would not pay his salary. This, then, would be but a bad bargain. In fact, I doubt if the *whole* income of many farms would be sufficient to pay him. *What* then should I, and others situated as I am, do for our chemist? I am aware that this objection does not lie as it respects Mr. Peyton; for I see from his communication that *he* is a chemist, and therefore need not employ one. But I, and perhaps more than nineteen-twentieths of the other farmers of Virginia, would each have to employ one, or at least one for every neighborhood. And the reason is simply this, that before I could venture with any prudence to plant my corn or sow my wheat in any field, I must first ascertain if that field contained the peculiar ingredient, and in that peculiar quantity, which are necessary to insure a crop. See how much Liebig's Göttingen farmer lost by not employing his chemist—his whole crops of grass "for many years!" Why this would ruin *me*, body and estate. But, jesting aside, it would really gratify me to see this visionary scheme carried into actual operation. And if Mr. Peyton will establish a farm on this principle—and, being a chemist, he is the fittest person that I know of to do so—I will leave my smoky atmosphere, and, with his permission, visit it. Such a thing appears very well on paper; I wish to see how it looks in practice. In fact, I have been a dyspeptic for nearly the last twelve months, and should be glad of an apology to visit the salubrious mountain region that he inhabits. How delightful, then, on such an excursion, to visit a field cultivated on this scientific plan—corn here, potatoes there, wheat, rye, oats, beans, pumpkins, turnips, not forgetting wormwood, every thing arranged in scientific order, according as the peculiar ingredients can be found, which are suited to each particular crop!

Now *my* theory on this whole subject is so simple and plain, that I am rid of all this vexatious trouble and expense. There is no chemist, except the cook, on the place, and yet we get along pretty well. Grass, it is known, is my main crop, and as I plant no wormwood to exhaust the potash, I have had, with the exception of one unusually dry year, very fair crops. I go upon the simple principle, that every crop of every description which I take off, and appropriate to my own use, is injurious to the land. If I see any field, or any part of a field, beginning to fail—and this I see much more frequently than I wish—I never send for a chemist to tell me what is wanting. I already know that it wants *fertility*, and this want I endeavor to supply by *manure*. And in the applications of manure I never trouble myself to inquire what *special* ingredients it contains—whether humus, or geine, or ammonia or silicate of potash, or phosphate of lime, or "a thousand and one" other hard names infinitely more familiar with Liebig and Mr. Peyton than they are with me. It is enough for me to know that these manures impart to my land *fertility*—"the one thing needful" to every crop.

But Mr. Peyton states another strong case upon the authority of Macaire Princep, and alluded to by Liebig, in which *leguminosæ* (beans, reader) are represented as having so filled the water in which they grew with their excretions, that a second crop would not grow in the same, whilst corn plants grew vigorously in the liquid;" and he calls upon me by name to account for this strange phenomenon. This case, I frankly confess, is too hard for me. I have planted beans, it is true, and I have a very flourishing crop of them in my garden at this time, but I never plant them in a *liquid*. I always plant them in the *soil*, just as I plant corn or potatoes, or any thing else; and if the soil is a fertile one, and I cultivate it well, I never have any trouble about their growth. I beg leave, therefore, to refer this strange affair, and all others of a similar character, to Liebig, or Macaire Princep, or some other of the chemical fraternity. Mr. Peyton tells me that the "genius of De Candolle revived and illustrated" this very thing. Liebig afterwards "modified it," in some slight degree; but I suppose the gentleman is not satisfied with the modification, and therefore calls on me to modify it still further. Really, sir, I would like to gratify you, but this whole affair is too *refined* for me. I never plant beans in the way these gentlemen speak of, and therefore know nothing about it. But if you must have a further modification, I think it more than probable that the very next writer on chemical agriculture will *modify the whole away*, and then at least *one* of us will be gratified.

And here, I will take occasion to say, is the foundation of all the objection that I have to scientific agriculture, or to farming on scientific principles. A chemist takes a vessel from his laboratory, in it he pours water, and in the water he puts some beans, just as I have seen my wife (she is a great florist) place her bulbous roots in flower vases, containing nothing but water and perhaps a little cotton to support the roots. In a little while the beans vegetate and show some disposition to grow. After a while the water be-

comes discolored. The first beans are now taken out, and others are put in the same liquid. These latter will not grow, but corn plants grow vigorously! And what can be the cause of it? *Some* cause *must* be assigned, and, for a better, here it is. The first beans so poisoned the water with their excrements, that the latter positively refused to grow. And this *one, solitary* experiment, tried, not in the field, but in the chemist's laboratory, and tried, too, in an element foreign to the growth of the article, is made the foundation of an extensive principle, which is to give a new aspect to the whole science of vegetable physiology! From the time of the first farmer, down to the time that this experiment was made in a chemist's shop, it was a matter of universal notoriety that, *provided* there was sufficient fertility in the soil, a *second* crop *would* succeed a first; but now it is found that the first crop so poisons the land by its excrements that the second will not grow. And so all the previous facts, which were so well established, must be made to yield to this one solitary instance. It is to *fooleries* of this character that I am utterly opposed; but to sound science, brought to the test of practical utility, and found pure, I am as decided a friend as can be found in America or Europe either.

But I am losing sight of my subject. Having now shown that I am no rotationist, either on the *peculiar ingredient* system, or for the sake of increasing, or even maintaining, a present fertility, which, by-the-by, as I still think, fairly covers the whole ground, I will proceed to state, that I advocate a change of crops, whenever I can make a greater profit by so doing. The *profit*, then, is the leading idea, by which I am governed in this thing. In illustration of this, I will suppose that there is a piece of ground just recovered from the forest. I will not sow grass, or wheat, or any other broad-cast crop there, because it is certain that with the soil unbroken, and the large quantities of litter on the ground, the seeds would not vegetate, and therefore a crop could not be reared. But I will plant corn, or tobacco, or some other crop there, which I can cultivate on the plan of drill husbandry, and in this manner may ultimately so cleanse and pulverize the land as to make it more profitable in a broad-cast crop. Or, there is a field which has borne several crops of grass: this field is now so filthy that it does not yield a profitable crop; at least the crop in something else would be *more* profitable, paying me at the same time for the labor of changing the crop. As a matter of good management, then, I would root up the grass, and substitute its place with that other crop. But this is not rotation. It is merely a change of the crop, not to effect any of the purposes of a rotation, but to make the land with its cropping as profitable as possible. If the field would yield a fairer profit in grass than in any other crop, I would continue it in grass for ever, and so of other crops.

And now I hope I have fully "defined my position" on the subject of rotations, and here, perhaps, I ought to drop Mr. Peyton. But there is another little matter to which I must call his attention. And, first, I am pleased that he had the courtesy to append his own proper name to his strictures. I have read these strictures with no unkind or even indignant feelings. The whole style of his piece shows that he is a scholar and a gentleman. I am not *certain*, but I suspect that my unknown antagonist is a *young* man. I like to see ardor and boldness in youth, but the gentleman will excuse me for saying that these qualities usually give place, in after age, to caution and modesty. With these remarks, I will call Mr. Peyton's attention to two sentences, in which I think he has done me injustice. I will not quote the objectionable sentences entire, but simply call his attention to them. He says, "Mr. Turner sets out rather ominously, in the midst of a strange confusion of technical terms," &c. Now I am utterly at a loss to conceive what can be Mr. Peyton's meaning in this and what follows. When I first read this, I thought I must have been betrayed into some incautious expression. I therefore carefully looked over the piece again; but still I cannot conceive on what this assertion is founded. If Mr. Peyton will have the goodness to point out that "strange confusion of technical terms," I will in disgust and mortification blot it from my manuscript. A little further on, he charges me with an attempt to "varnish," &c. Now all my positions are so plain, and all my illustrations are so simple, that I need no varnishes to cover their defects.

The other objectionable sentence occurs near the beginning of the strictures. It is there said, that from my "successful farming and well-written communications," &c., and then it is more than insinuated, that I am trying to pervert my influence to the injury of my brethren. To this grave charge, I again plead "not guilty." But even if guilty, I am consoled with the fact, that there is such an *able* opponent to make the antidote commensurate with the bane. With these remarks, and with the kindest feelings, I take leave of Mr. Peyton.

But my work is only half done. A new adversary presents himself, and a new scene opens before me. I leave Mr. Peyton, Macaire Princep, Liebig, and other literary characters, to settle their own grave concerns, in their own way, but it is only to encounter the formidable editor of the Farmers' Register. I leave the field of science, but, strange to tell, wearing a black coat as I do, it is to enter the field of chivalry!

And now I have an adversary of a different order to contend with, old, experienced, sage, cautious, a *veteran* in the cause, with courage sufficient to make a bold soldier, and with prudence to moderate it. I think, however, that he shows more boldness when he has some associate in arms to lead on the attack, than when he comes to the conflict alone. Such is the adversary with whom I now grapple.

And here, passing by that pretty figure about knight errantry, and "knight challenger, and Le Noir Faineant," and "all that sort of thing," which it seems was so pretty that the editor could not resist it, though in availing himself of it, he makes me appear a little ridiculous—also, passing by all that he says about the universality of rotations as practised by judicious farmers, I come at once to the main thing in hand. But first I wish to say a passing word about this "knight challenger," whom the editor introduces with such a flourish. And if he means *me*, I must remind him that I was enjoying a peaceful retirement at my farm, until he came in and *tempted* me from it. We read in the good book of two other persons, who were enjoying a simi-

lar retirement at their quiet retreat. But another tempter came in and lured them from it. If then *I* am "Le Noir Faineant," *who is the editor?*

Now the editor is very slow in coming to this contest, but as soon as he finds that he has a gallant associate in arms, who will lead on the attack, he comes to it very boldly. Disdaining all aid from the Frenchmen and all other scientific authority, in the confidence of his success, he boldly rests his whole argument on two points. "Mr. Turner is an intelligent, observant, practical and successful farmer." Mr. Turner is in favor of rotations, and I cite him as my witness to prove it. *Nature* also alternates her crops. Therefore rotations are necessary—Q. E. D. But not so fast, Mr. Editor, let us look into this thing a little.

It is true that I do practise a change of crops, not from choice, but from necessity; and in a preceding part of this paper, I have stated the *extent* and the reasons *why* I do so; and the editor may make the most of it. But the editor, using me as his witness, says, that "Mr. Turner's statement of his own herds-grass giving way, after a few years, to green-sward or weeds, is not only a proof of this position, but of nature's urgent demand for a change of crops." Thus he brings both his arguments to bear upon the main point at the same time; and this at once opens the whole field of controversy.

But before I enter upon the subject in hand, it is necessary to premise a few things. I state then, in the most distinct manner, that I make no pretensions whatever to any thing like a *critical* acquaintance with vegetable physiology. With the exception of a few short detached pieces, I have read nothing on this subject. But I have eyes, somewhat dimmed by age it is true, and I have thoughts, and I have tried to use them also. A book has been constantly before me, "the open volume of nature," the pages of which I have made it my habit to consult more or less every day. From this book then I have learned some strange things, which I propose now to detail.

Among other things I have learned that nature and art, in all their designs and in all their operations, are as completely and as thoroughly opposed to each other, as any two things can possibly be. By the term *art*, I here mean all the operations of man in which *cropping* is concerned. Considered in this respect, light and darkness are not more really and truly at variance, than nature and art. They are not only opposed in their very *being*, but also in the whole course of their operations. Whatever, therefore, the one endeavors to do, the other endeavors to *undo*. If man digs a ditch, nature immediately begins to fill it up. If man erects an enclosure around his field, nature at once begins to pull it down; and if man builds a house to dwell in, nature directly begins the work of dilapidation upon it.

Nature and man are also directly at variance in regard to their wants. The wants of man are as numerous as the "stars of heaven or the sands on the seashore." *Nature*, on the other hand, has but one want, and that is rich fertile lands. This object she constantly pursues with the most untiring and patient perseverance. If a *weed* springs up, and nature is not counteracted in her course, she uses it to enrich the spot on which it grew. If a *leaf* falls to the ground, nature makes use of it to nourish the tree that produced it, or if a *limb* or even a *twig* is broken off, nature, with the most admirable economy, changes it into nutriment, to be employed in the same way. Thus nature with her trees, her shrubs, her weeds, her grasses, and in fact with every thing else which she has under her exclusive control, is constantly, is steadily employed in enriching her lands. But what is the case in regard to art? It is well known that the whole policy of cultivation is not to *enrich*, but to *impoverish* the land. Instead, therefore, of giving our *artificial* crops to the land, as nature does the whole of her *natural* crops, man takes them all off. And instead of enriching our lands as nature does, man constantly impoverishes them.

I observe further, that the *crops* which nature and art cultivate are just as distinct as the objects are for which they are cultivated. Nature has *her* crops, and man has *his* also; and they are as distinct as the objects are to which they are to be applied. Nature rears her mosses, her lichens, her shrubs, her grasses, called natural or indigenous, but the crop in which she seems to take especial delight, is her own forest tree. Man, on the other hand, cultivates his corn, his wheat, those grasses which are called artificial, and the fruit tree. Nature never cultivates the artificial grasses, because weeds and natural grasses answer her purpose better. If, therefore, the artificial grasses are made to grow, it is only at the expense of labor and trouble, and nature is trying all the time to destroy them. The whole system of cultivation, therefore, is a counteraction of nature, and it is a counteraction which she continually opposes.

In accordance with this we see, that when we fell the forest, nature immediately makes a strong effort to restore it. Sprouts spring up, and young trees make their appearance, so that if we fail to remove them, nature will soon erect a forest in the same place again. In the same manner, when man plants any of his crops, nature abhors them, and does every thing in her power to destroy them. Her great object is to put *her own crops* in the same place. Hence it is that a war is constantly waging between them, and this war is of the most deadly character, amounting to nothing short of actual extermination. Man tries to destroy nature's crop, and nature tries to destroy man's crop. The whole object of ploughing, weeding, &c., is merely to destroy nature's crop, and nature, with her weeds and grasses, tries to destroy man's crop. Now, the editor knew all these strange things very well when he was a *practical* farmer. But since he has laid aside the plough, and taken the pen in its stead, he has perhaps forgotten them. I therefore take the liberty of bringing them to his remembrance.

With these remarks, not one of which, I am bold to say, can be controverted, I feel, as the witness cited in the case, no difficulty in telling *why* "Mr. Turner's herds-grass gives place after a few years to green-sward, or to weeds." It is not because the land is *tired* of the herds-grass and requires a rotation; but it is simply and truly because herds-grass is an artificial grass. It is one of man's crops. Nature therefore abhors it, and does every thing in her power, from the very beginning, to destroy it. If herds-grass

had been less hardy, less tenacious of its hold, nature would have effected its destruction at an earlier period. As it is, it required three years to accomplish it. But what are three years or three thousand years in the account of nature? Green-sward on the other hand is a natural grass. It is one of nature's crops, and one of the uses which she makes of it is to destroy man's artificial crop.

But this argument, to be worth any thing, must go a step further. If herds-grass yields to green-sward because the land is tired of it, or because it has taken up all the peculiar ingredients in the soil which are fitted for it, as the editor and his associate intimate,* and therefore requires an alternation, then, for the same reason, in three *more* years, the land ought to be tired of the *green-sward*, and the green-sward ought in its turn to yield to the herds-grass. But this I utterly deny, and the editor dare not avow it. Nature has her various grasses, but this seems to be her favorite. When therefore I see my herds-grass yielding to green-sward or weeds, which unfortunately is too frequently for my comfort or profit, I ascribe it, not to a propensity to alternate, but to that *struggle* which nature is continually making to destroy my artificial crops, and it seems to me that the editor must in candor ascribe it to the same.

But if the editor will favor me with a visit, I will show him an argument much more in point, and much stronger in force, than the one he has adduced. Last spring I planted my corn about the usual time, perhaps a little earlier, and during all its early stages cultivated it well. But for the last four weeks we have had an almost constant succession of cloudy weather, attended with frequent showers of rain, some of which have been very heavy. The consequence is, that our ploughs, cultivators and hoes, have been almost entirely banished from the field, and the whole field, from the excess of grass and weeds, presents at this time the most mortifying aspect. But what can be the reason of this? "Oh, I can tell," says the editor, "and I cite Mr. Turner as my witness to prove it, the land is tired of the corn, and therefore seeks to alternate it." What! *tired in three short months*? Or is it not, as I stated, that nature with *her* crop of grass and weeds, is seeking to destroy my crop of art, and has taken advantage of the unusually wet season to effect her purpose?

But it was stated some time ago, that nature's great and favorite crop was the forest tree. Indeed the chief and prominent object of nature seems to be to cover the whole face of the earth with her trees. She has them of the greatest variety, and she plants and nurtures them in every practicable situation. *Some* grow even in the water, and I have seen them growing also on the hard rock, where there was but a scant supply of soil to sustain them. Indeed I think it not improbable, visionary as it may appear, that large sections of land in the "Valley of Virginia," now covered with forests of immense trees, were once nothing but a naked lime-stone rock. How else can we account for the remarkable shallowness of the soil? Now I do not say that nature planted her trees originally on the naked rock. She was too skilful a manager for such a blunder as that. But, in the first instance, she planted what *could* and actually *did* grow there, viz.: mosses and lichens. With these, using the time to decompose them, she first formed a little thin soil. Here was a beginning. Afterwards she probably employed grasses, first of the lower and then of the higher orders. After this shrubs, &c., until, in the long lapse of time, she accumulated soil enough for her favorite crop, the forest tree, and then she planted it. And now she has the crop to which all her efforts were directed from the very beginning.

Now here I have supposed an extreme case, from no soil at all, there has been soil enough formed to sustain the forest tree. In bringing about this result, great changes have taken place, the moss has yielded to the grass; the grass to the shrub, and the shrub to the forest tree. And do not these changes prove rotation? Not at all. On the other hand, I fearlessly affirm, that *not one* of these changes was made for any of the purposes of rotation; but they are all to be regarded merely and solely as so many preparatory steps towards nature's final crop. You might as well tell me that ploughing, harrowing, manuring and planting are so many rotations, as that the preparatory measures adopted by nature, with reference to her crop, are so many rotations. Nature, it is true, has no stable nor farm-pen to furnish manure. Nor has she a plough, or hoe, or spade, with which to prepare her lands. But still she has her own resources, decaying vegetation, and the frosts of winter, and these she employs in the most untiring manner, until she brings her lands into the proper state to receive her crop, and then she plants it. All the gradations, however, from one material to another, in the mean time, are not to be regarded as so many rotations, but simply as so many links in the great chain of preparation.

We will now suppose that the great business of preparation is at last completed, and that nature's grand crop, the crop in which she seems to take special delight, the forest tree, is actually planted. The question is, does she ever change it? The editor affirms, but I deny; and thus we are directly at issue. But the editor demands, when the forest of oak has been removed, and another forest grows up, is not the latter different from the former? True! but whose work is this? Is it nature's? Did nature destroy her own forest of oak? Or rather, did not man destroy it? Here man came in, and interfered with nature in her steady operations. He violently took away the crop in which nature glories, and he substituted his own artificial crop, a crop that nature abominates in the place of it. This crop he constantly appropriated, year after year, to his own use, returning nothing to the land which produced it, until fertility is destroyed, and positive impoverishment has been fixed upon it. In this state, he gives the land back again to nature. And how does nature manage it now? Does she put the same crop on it as before? By no means. She has too much skill for this; but finding the land in a very different situation, she varies the crop according to the different circumstances in which she finds it, wisely adapting her

* This is a mistake, as to the editor. The doctrine may be solid, or it may be groundless; but we neither assumed it, nor referred to it.—Ed. F. R.

crop to the present impoverished situation of the land. The change therefore, from the hard wood to the soft, is not properly an *alternation*, it is merely a change brought about by the peculiarity of the case. If I have a piece of land so poor that it will not produce turnips, and I plant peas there, is this an alternation? No one will pretend that it is. No more can *that* be regarded as an alternation, when nature, finding that her land will not produce the former crop, plants a different one on it.

Having now disposed of the case on which the editor seems to rely with so much confidence, I go a step further and say, that nature *unviolated*, but let alone in her own free course, *never alternates her crops*. Go to some sequestered spot where man has never been, if such a spot can be found, and where violence of no other kind, by tempest, by flood, nor by fire, has ever been inflicted, and the forest which was of oak, a thousand years ago, is a forest of oak still. I insist upon it, that no instance can be adduced, in which nature, left to her own free course, has been known to alternate an oak for a pine, or a pine for an oak. Such changes do constantly occur where *man* has been at work, but then the handy work of man has been the cause of it.

Furthermore, if the editor will favor me with a visit, (I am too busy at this time to visit him,) I will show him, what it seems is a strange sight in his section of country, and I suppose will be equally strange to his associate, Mr. Peyton, also, and that is not *one* young oak, but *great multitudes* of them, growing from the decaying stumps of the parent tree, and nourished by what I call the *humus* of the same. It seems that no such thing ever occurs in the editor's country; but there, when a tree dies in the natural way, or is uprooted by the storm, or destroyed by fire or inundation, it is succeeded by a tree of different order. Even the long-leafed pine, or the short-leafed pine, is succeeded by the old-field pine—a tree of different order. Now *here*, I assure the editor that I witness the *fact* as stated above, and I venture to assert that it will be found to exist in a great many other places. Changes of this character, I admit, do often take place, but rarely, if ever, except where a change has been effected in the condition of the land. Let the land remain the same, and leave nature to work in her own way, and the forest, which is her main and final crop, will remain the same. If under these circumstances the oak dies, another oak will spring up from the stump to supply its place.

I will also mention that along the fence which divides my neighbor's land from mine there is a line of locusts planted. These locusts send their roots to a considerable distance into my field, and thus I am plagued every year in grubbing up the young sprouts which issue from them. There is also an Otaheitan mulberry standing in the corner of my yard, (I wish it was somewhere else,) which has extended its roots into the garden and the adjoining field; and here also, I have no little trouble in keeping down the young shoots. It is also notorious, that the aspen is remarkable for covering the whole space occupied by its roots with a multitude of *young* aspens. But I shall be told—these all proceed from the *roots*. I know it; but I ask, in my turn—why do not these roots so exhaust the peculiar ingredients fitted for the tree, as to render the land incapable of rearing the same? If in these cases the locust was cut down, would a mulberry spring up? Or if the mulberry were cut down, would an aspen take its place? Or if the aspen were removed would a pine make its appearance?

But *I* am exhausted, though my *subject* is not. This business of meeting two such formidable antagonists at once, *though* in separate order, is hard work. I must, however, say something about the admirable economy of nature in compassing her main object. I have elsewhere stated, I think in the piece commented on, that nature has but one want, and that is *rich lands*. All her efforts seem to tend to this one point. She abhors the idea that there should be a barren or unproductive spot in any part of her vast farm. We have seen that she will even take the naked rock, and first clothe it with verdure, and then plant the grand forest tree there. And how does she effect this? It is simply by husbanding all her resources, and then, with an admirable skill, turning them to the best account. Nature never wastes any thing. Not a weed, not a leaf, not even a bit of moss is thrown away by her. In her *productions*, also, we see this wonderful skill displayed. She produces but little *fruit*, for she has no use for it. Whilst this is the case, it is wonderful what a multitude of *berries* ornament the plants, the shrubs and the small trees of nature. For these she has a use, and that is to feed the immense numbers of her beautiful birds. But man can gather ten times as much fruit from one of *his* small trees, as can be gathered from one of nature's huge oaks. But if nature be deficient in the production of fruit, she is by no means deficient in providing the means by which she may enrich her lands. If, therefore, the oak produce but few acorns, it produces a large crop of leaves; acorns also often fail, but leaves never.

The above may perhaps be regarded as mere fancy. Not so. I have a distinct object in stating it, and that is to illustrate further what I have said about that deadly warfare which nature is carrying on upon the cultivation of man. She regards the whole world as her property. She claims every acre, every inch of the land as her own. Her main, her constant object, an object which she has pursued for thousands of years with the most untiring perseverance, is to make every foot of the land *rich*. This she does by taking off nothing, but restoring the whole product, weeds, grass, leaves, to the land. Now the very tendency and policy of cultivation is to defeat nature in this her favorite object, and this, in my opinion, is the cause of that *deadly* grudge which she owes to man.

This then is my theory of vegetable physiology. And now, Mr. Editor, what think you of it? I did not learn it from Macaire Princep, nor De Candolle, nor Liebig. I left these gentlemen, you recollect, some time ago, discussing with your worthy associate about a second crop of *beans* refusing to grow in water. *I* am, for *my* part, much more surprised, that the *first* grew, than that the *second did not*. However, it was a *grave* matter among them. One *started* it, a second *revived* it, and the third *modified* it *a little*. If your associate can leave these gentlemen for a moment, I will say to you singly or jointly, that if you choose to leave this discussion *here*, I am

content. But if you or he, or both of you, throw down the glove, I cannot, as the "knight challenger," Le Noir Faineant, refuse to pick it up.

But before I dismiss the editor, I must say one or two more things to him. One of the reasons assigned why he did not earlier oppose my "heterodox" opinions on the subject of rotations, is that he is "already engaged to oppose me upon one particular ground of controversy, which could not be avoided." This allusion I suppose is to the subject of liming. Now why he has not already met and opposed me on this subject, I cannot tell; unless indeed, he is waiting for some more daring knight to bring on the attack. The editor also intimates, in another place, that I have "shifted my ground" on this subject. This I regard as no charge at all. I have, upon further thought, and under the influence of sound argument, shifted my ground more than *fifty* times in the course of my life. And if the editor or his associate, either singly or jointly, can convince me that the positions taken in this paper, or in any of my papers, are wrong, they will find no one more ready to shift his ground, than their humble servant,

J. H. Turner.

[We have no desire, nor indeed is there any ground left, for continuing this discussion; for not only does Mr. Turner's practice, (as before adduced,) but also his reasoning, (as now presented,) go to sustain our own position in favor of rotation of crops. The only reason for rotation which we assumed in our remarks, (though not the only one which might have been maintained,) was, that one kind of crop prepared the land better for another kind, and that when so changed, the products and the profits would be greater than by continuing any one kind of crop. This Mr. Turner as fully maintains, and therefore we are altogether in accordance on this, which is the main question.—Ed. F. R.]

NATURAL CHANGES OF THE KINDS OF SUCCESSIVE GROWTHS OF TREES.

[In the preceding number, reference was made to this subject, and some general facts stated in proof of the truth of such natural and entire changes. The following extracts, from communications to the Philadelphia Agricultural Society by the venerable Judge Peters, and from the letters of some of his correspondents, are presented as more particular evidence and better authority, for such of the facts as are not notorious here.—Ed. F. R.]

Extract from a communication by Judge Richard Peters. (Memoirs, Phil. Agr. Soc. vol. i. p. 28.)

"There is an account in the public prints of the general decay of the *pine-woods* in South Carolina; effected by a disease, which commenced in 1802. It would be highly useful to ascertain and record the facts, relative to this catastrophe. It has fallen under my observation to know, that this phenomenon is not rare, or singlular. Intelligent surveyors, who have been occupied in running out new lands, in Pennsylvania and other states, remark, in a variety of instances, a total change of timber, in many extensive districts of the wilderness. They discover by the fallen timber, coated with a diversity of the *mosses* (by which the air, and other means of decay, being excluded, they were the better preserved) that the present forest trees are entirely different from those of the former growth. Those prostrate are, in many instances, of the resinous tribe, where those of a totally different kind are now growing, of enormous dimensions; in sites where white pine, pitch pine, and hemlock had formerly possession; so that the living timber must be very ancient. The largest trees majestically flourish among the fallen trunks of their predecessors. Those of us who have traversed our distant forests, especially beyond the mountains, where the timber is truly gigantic, must have noticed this striking circumstance. The variegated verdure of these immense recumbent trunks, numerous and extensive, affords to the traveller a curious, pleasing, picturesque, and stupendous contrast, with the dusky glooms of the shades surrounding him.

"In my memory, on a smaller scale, a total change of timber has occurred, in a tract of mine, containing about 800 acres, in Northampton county. Previously to our revolution, perhaps 35 years ago, I knew it to be covered with *pitch pine*. It was called the *Pine Tract*. This first growth of timber having been blown down by a tornado, was consumed by fires of the woods, a practice mischievously common in that quarter. It is now entirely reclothed with *oak*, *hickory*, and other valuable well grown and thriving timber; and scarcely a *pine* tree is to be seen. I can give (within my own knowledge) several instances similar, but of less extent. One, of a fine grove of *white pine*, thrown up spontaneously, on old fields, where no timber of that species had originally grown; and far from any such timber. Another, of a large body of valuable *chestnut*, where a person, now living, has reaped wheat and other grain; and where *hickory* and *oak* had been the precedent growth; and no timber but of the latter kinds, is now to be seen in the adjacent lands. May it not therefore be probable, that a change in the timber of the southern country is about to take place? Dissolution and renovation, are constant operations in nature. Some whole races of animals have become extinct. The *mammoth*, the former monarch of the woods, is a proof, in the knowledge of every body. Beasts of a very different race now occupy his haunts. Yet this has excited more curiosity, than important research, or useful inquiry.

"I do not find that the particular species of timber growing on land, invariably designates its qualities, or strength; although it is certain, that some kinds are the most frequently found, on lands of similar quality. I have known *hemlock*, white *pine* and pitch *pine*, grow on very rich, deep stapled, and strong land; as well as on the most sandy, thin and sterile soils."—p. 37.

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"Since this communication, I have met, acci-

dentally, with a critique in the *Edinburgh Review*, vol. i. 1802 3, on *Mackenzie's Voyages*. It calls to my recollection a confirmatory fact, mentioned by him. He alleges it to be "a very curious and extraordinary circumstance, that land covered with *spruce pine* and *white birch*, when laid waste by fire, should subsequently *produce nothing but poplars*, where none of that species of tree was previously to be found." The reviewers speak incredulously of this fact, which is nevertheless undoubtedly true; and corroborative of similar relations. Many of the *phenomena* of nature pass so often without notice, that they appear incredible, when our attention to them is awakened."—p. 37—8.

Dr. James Mease adds the following:

"The cause of the rapid and alarming decay of the pine timber in South Carolina, is an insect or bug which was first observed in the northern and eastern parts of the state about six years since. It is a small black winged bug resembling the weevil, but somewhat larger. A great number of these bugs have been observed in the spring of the year, and early in the summer, flying near the roots of the trees; they pierce the bark a little distance above the ground, and lay their eggs between the bark and wood; in a few weeks after, these eggs hatch, and a worm appears, which, at its full growth, is about an inch long; they immediately begin to feed on the sappy part of the tree, and do not cease eating until the whole of it is destroyed.

"Very considerable injury has been done by these insects to the pines of South Carolina. In one place, viz., on the Sampit creek, near Georgetown, in a tract of two thousand acres of pine land, it has been calculated that ninety trees in every hundred have been destroyed by this pernicious insect; the adjoining lands, and many tracts on the Santee and Black rivers have equally suffered. The fact of an oak springing up in the place of a fallen pine tree, and of the latter appearing when the former is cut, in the southern states, is known to every one there."—41.

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"Mr. Hearne says, that 'strawberries of a considerable size, and excellent flavor, are found as far north as Churchill river, and that it is remarkable, they are frequently known to be more plentiful in such places as have formerly been set on fire. This is not peculiar to the strawberry, for it is well known, in the interior parts of the country, as well as at Albany, and Moose forts, that after the underwood and moss have been set on fire, raspberry bushes and hips have shot up in great numbers on spots where nothing of the kind had ever been seen before.'—*Journey to Northern Ocean, page* 452. *Lond.* 1795.

"Mr. Cartwright also observes, 'that if through carelessness of those who make fires in the woods, or by lightning, the old spruce woods are burnt, Indian tea is generally the first thing which comes up: currants follow next, and after them, birch.'—*Journal of Transactions at Labrador. Vol.* 3. *p.* 225.

"The following extract of a letter to the writer, from John Adlum, Esq., of Havre-de-Grace, Maryland, dated September 16th, 1807, is a further confirmation of the point here in discussion. Every one who knows the high authority of Mr. Adlum, as an accurate observer, will duly estimate the facts he details.

"'As to your query respecting a rotation or succession of forest trees, I am as well satisfied of it, in my own mind, as if I had lived to see the whole change for centuries back; and although it may be difficult to give the kind of information, that may be satisfactory, I have no doubt that I could convince any person as to the fact, were he to travel over the country with me.

"'I first took the idea in the summer of 1788, when I was surveying lands south of the great bend of Susquehanna, between that river and the Delaware, in what is called the beech and sugar maple country. In the course of my surveying, I traversed some places, consisting of a few acres each, growing red and white oak trees of an enormous size, none being less than sixteen feet in circumference, five feet above the ground, and generally from 40 to 50 feet to the first branches; some few red oaks were 22 feet in circumference, and the white oaks 20 feet round. I was struck with astonishment to meet a few trees of the oak kind, considering that I had not seen any for some weeks. After discovering the first few, I kept a look out for more such places, and as well as I can remember, I found two more of the same kind, containing trees of the same enormous size, but no small oaks nearer than the large waters emptying into the Susquehanna and Delaware. The places mentioned, were near the heads of those rivers, and where the streams were small, I invariably found small bodies of very large hemlock (*Pinus abies Americana*) trees, (the prevailing timber,) near those places; the remainder of the trees consisted of beech, sugar maple, with a few white walnut, (*Juglans alba,*) white ash, birch, &c., but no oaks.

"'In those parts of the country, where the prevailing timber consisted of sugar maple, beech, and birch, I observed large trees growing as it were on stilts, their roots being three feet above the ground, which trees undoubtedly grew on old logs that had either fallen with age, or had been thrown down by hurricanes, and had rotted away from the roots of the trees."

"'The clumps of oak and hemlock are generally in the midst of, or surrounded by large bodies of beech and sugar maple lands, mixed with some ash, and a few wild cherry and hemlock trees. In some parts of the country, the prevailing timber is still hemlock, on the sides of hills, and along streams.

"'From the circumstance of the great size of all the oak trees growing in the spots noted above, it appears to me that most of the high country, including the head waters of the Delaware, Alleghany and Chenesee rivers, was originally an oak country. The hemlock appears to have succeeded the oak, for there is still a considerable quantity of that timber over the face of the country, but from the number of logs of it lying on the ground, and its visible decline, I think the beech, sugar maple, &c. succeeded the hemlock, as they are the prevailing timber at present. The timber that appears to me will take place of all others in the country before mentioned, is the white ash and wild cherry, for I observed that all places where the woods have been blown down by hurricanes for a number of years back, the young growth consists principally of those two kinds of trees,

and the largest saplings of them which I saw, were six to nine inches diameter. I suppose that the appearance of the latter trees commenced between twenty and thirty years back, counting from 1794 or 1795. There are several of those wind falls, in the remote parts of Pennsylvania and New York, near the line dividing the two states; they are generally 1-8, rarely 3-4 of a mile wide, and several miles long, and in every one that I saw, and that did not appear to have happened more than from 20 to 30 years ago, the ash and wild cherry were the prevailing timber; there were indeed other trees growing among those, but from their appearance very few of them would attain to a large size except some birch, and I have no doubt, that if cultivating the country does not make some alteration in it, in another century, the beech, sugar maple, hemlock, &c. will be as scarce in those parts of the country, where they now abound, as the oak is at present.'"—42—45. * * * *

A later communication to the same publication from Judge Peters furnishes the following passages:

"In a conversation with Mr. Rembrandt Peale, who adds to talents promising to render him greatly eminent as a portrait painter, a knowledge of natural history, in some of its most curious branches, the subject of changes of timber was mentioned. He informed me of the circumstances attending their search for the bones of the mammoth, in Orange and Ulster counties, in the state of New York, in 1801. He was so kind as to gratify me, by presenting to me two pamphlets; accompanied by a letter, which I send for the perusal of the society. I transcribe the passage he alludes to, relating to the timber."

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"'Many of the cavities (says Mr. Peale's pamphlet between these knolls are dry, others are in a in a state of ponds, but an infinite number containing morasses, which must originally have been ponds, supplied by springs which still flow at their bottoms, and filled in the course of ages with a succession of shell fish and the decay of vegetables; so that at present they are covered with timber, and have been so within the memory of man. An old man, upwards of sixty, informed us that all the difference he could remark between these morasses now, and what they were fifty years ago, was, that then they were generally covered with firs, and now with beech. This was verified by the branches and logs of fir which we found in digging; many pieces of which had been cut by beavers, the former inhabitants of these places, when in the state of ponds. Scarcely a fir is now to be found in the country.'"—298.

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Judge Peters continues,

"My son Richard, who, with Mr. Adlum, accompanied me, in 1797 or 1798, on a tour into the wilderness in Lycoming county, to view some of my new lands, reminds me, that on these lands, invariably, the old decayed timber long blown down, or fallen with age, was of an entirely different species from that standing. We found flourishing ash, 6 feet diameter, sugar maple 6 feet through; and we measured one buttonwood, on some fine rich bottoms on the waters of the Loyalsock, thriving and healthy, 11 feet 8 inches diameter. These bottoms were covered with flourishing shell bark hickory, wild cherry, white walnut, and an immense variety of plums; though the whole country, in other parts, had no other timber than beach, sugar maple and hemlock; and some stately chestnuts on the ridges. My son also brings to my recollection, that when we surveyed the tract, called in old times the Pine Tract, in Northampton county, a great number of ash trees were intermixed with the present growth of oak and hickory."

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A letter from Rembrandt Peale says,

"'In addition to this paragraph, I need only remark, that these morasses contain abundance of pine burs,* together with the trunks and branches of wood evidently pine (specimens of both are now in the Museum, case No. 4,) of which I do not remember to have seen a tree growing in the neighborhood, and that it is only from the circumstance being so universally known by the inhabitants that it is not often spoken of.'"—p. 300.

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Dr. Charles Caldwell, formerly of North Carolina, writes as follows:

"In other parts of North Carolina, where the growth of timber consists almost entirely of oak and hickory, if this be removed, it will be succeeded in a few years by a general and plentiful crop of young pines. Nor is it necessary to the success of this experiment, that the place cleared should be in a piny neighborhood. The event will take place with equal certainty, though there be not a pine within many miles."

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"Certain tracts of that state (New Jersey) are covered entirely with forests of pine. If these be cut down, and the land not put immediately under cultivation, they are succeeded in a few years by a plentiful growth of young oaks. I am told that in some parts of New Jersey, nurseries of young oaks produced in this way are to be found in the centre of extensive forests of pine. I will not vouch for the truth of this fact. All I can say respecting it is, that I received it from a very respectable source, and that it perfectly comports in principle with what I have myself seen.

"In the course of the last century, the white pine sprang up spontaneously in a place called Duxborough, in the state of Massachusetts, without having been previously a native of the neighborhood. Between twenty and thirty years ago, there was a man still living who had a perfect recollection of the first pine that ever made its appearance in the township; whereas, at

*"This not only proves the pre-existence of a growth of pine timber, on the lands now occupied by a species entirely different; but it goes much further, in support of the analogy between natural and artificial products. This 'abundance of pine burs,' which we know contain the seed, found on these lands, is an indisputable evidence of there having been seed in plenty to produce pine timber, if the land had not been pine-sick:—to use a country phrase, applied to lands which will no longer admit of a repetition of the same kind of crop. R. PETERS."

present, that plant constitutes one-eighth part of the timber of the place. Though I can give no personal testimony in support of this fact, I notwithstanding believe it to be true."—p. 305—6.

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And Thomas F. Leaming writes thus to Judge Peters:

"For some years past I have been in the habit of visiting some estates which belong to our family, in the county of Cape May, New Jersey, and have remarked myself, and heard it as a common fact, that wherever the pine timber is cut off, oaks invariably and hickories very frequently will spring up, and this is also the case where the timber has been taken off by fire; the hunting grounds, which lay in the upper part of Cape May and lower part of Cumberland counties, are set on fire very frequently, in the spring, to burn the under brush to facilitate hunting in the autumn; and although the timber is altogether pine, yet no pine springs up after the burning; while oaks and hickories invariably do. On the Penn tract, lying a few miles below Bridgetown, in Cumberland county, there have been for several years straggling settlers, who have taken possession, and cleared some parts they have tilled; and other parts have been suffered to grow up. Nearly the whole of this tract was pine timber; and wherever it has been cut, oaks and hickories have grown up; and for several miles along the post road, which runs through it, I have seen black oaks stripped of the bark (for the purpose of tanning, &c.) where I have been credibly informed there was nothing but pine timber a few years since. If my statement of this well known fact will be of any service to you, you have my free assent to use it as suits your purpose, and in conclusion I will observe that I am convinced there is not a man of any observation in the counties of Cumberland, Gloucester and Cape May, but will confirm what I have mentioned."—p. 308—9.

ESSAY ON THE ARTIFICIAL GRASSES SUITED TO OUR CLIMATE AND SOIL. THE LEAST INJURIOUS MODE OF GRAZING. THE MODE OF PREPARING MEADOWS, PRESERVING THEM, AND MAKING HAY.

For the Farmers' Register.

1. A delusion has long prevailed, that our section of Virginia is not adapted to the growth of grass. Abundant and incontestable evidence can be adduced to prove, that wherever well-directed efforts have been made to promote its growth, they have met with success. The delusion has arisen from observing the effects of that scourging tillage which has been practised, it is believed, ever since our noble forests surrendered to the woodsman's axe. When our lands ceased to produce good crops of tobacco, vegetation was prevented or destroyed for the benefit of the corn crop, wheat followed corn, hogs and cattle were the gleaners of the wheat field, and every sprig of grass which came up during the remainder of that and the whole of the next year was greedily devoured by a hungry stock, which roamed in what was misnamed the pasture-field. How unreasonable to expect that grass could grow under such a system! And yet, because it did not, our lands were denounced, our farmers began to believe the oft-repeated slander—and many emigrated in quest of the grassy regions of the west. Happily for us who remain, it has been discovered that injustice has been committed—that under kind treatment and a sanative system, our lands may again smile in verdure—that the long-legged hog may be shoved aside by the chubby breeds which yield the nice round ham, and Durhams and Devons may chew the cud, reposing on beds of luxuriant clover. This is a picture which we may realize by careful attention to the growth of artificial grasses.*

2. Experience shows that red clover is well adapted to most of the arable lands of eastern Virginia. It grows best in a dry soil. Indeed, none of the artificial grasses will flourish in wet lands. Let one gallon of clover seed be sown to the acre, as early in the spring as may be deemed safe from freezing weather. If the land be harrowed when the seed is sown, it will probably be better protected from the late spring frosts. Farmers who have done this, think the wheat as well as clover is improved by this process; but it is generally inconvenient at this season to pursue it, and may be dispensed with.† The ground will then be found covered with cracks to admit the seeds, which the first rain will cover. When the land has been sown with clover for a series of years, half a gallon to the acre will be sufficient; but in sowing lots for cutting or grazing heavily, two gallons, and even 2½ gallons, are recommended by skilful farmers.

3. To insure the growth of clover, a liberal use of plaster is indispensable. In a rich soil, and with a favorable season, it *may* grow without the aid of plaster—but it is likely to assume a yellow, sickly hue, even if it survive the summer's sun. The best mode of sowing is to soak the seed one night in water, and mix with it double its quantity of plaster. On land where the soil had been worn bare, and completely impoverished by severe cropping and grazing, this method has produced a fine growth. I would recommend this practice to be always pursued.‡ It is follow-

* Doctor Archer, whose farm is near Fortress Monroe, Old Point Comfort, gives strong testimony on this subject. In the 1st vol. of the Farmers' Register, p. 399, he says, "I do not hazard too much when I say, that timothy, herds-grass, orchard grass, tall meadow oat, feather grass, clover, and lucerne, all of which I have fairly tried, thrive as well and grow as luxuriantly as in most parts of our extensive country. For five years I have turned my attention very much to this branch of agriculture; two or three interprising gentlemen in this, and in Norfolk county, have done the same. The charm is now broken, all acknowledge that our hay is as good as ever was imported from the eastward; and in a few years, I hope to see our old fields transformed into profitable meadows."

† When stiff, *glazed* wheat land is sown, the use of the harrow is almost indispensable to loosen the soil for the reception of the seeds, else they bound into the water furrow, or lie exposed to sun and frost, and, being unable to insert their roots, perish after they have vegetated.

‡ The writer has a fine lot of clover, which was sown after rye on the 8th of September last. He

ed by other advantages besides the invaluable benefit of insuring a good growth. The seed is more easily sown and more equally distributed —it saves the labor of sowing plaster during the first spring, and relieves the wheat from the danger of being more liable to rust by the application of plaster sown broad-cast, a danger, however, which has never been observed by the writer, though it is deemed by some farmers to be incurred. Twelve months after the clover is thus sown, it should be plastered during moist or showery weather, with about one bushel to the acre. Towards the last of May, or early in June, the bloom begins to assume a brownish hue, and it is then fit for the scythe, if designed for hay or for feeding green to cattle—but if sown for the purpose of restoring fertility to an exhausted soil, or renewing its energy after a debilitating crop, the most judicious plan is to leave it unmolested until after harvest, when it is beginning to fall upon the land, and its stalks become hard. The grazing of cattle may then be permitted; though it is prudent to remove them in wet weather. Mr. Carter, of Shirley, thinks this mode of grazing beneficial.*

4. Timothy (*Phleum pratense*) grows well in good soils, in both low and elevated situations. Herds-grass (*Agrostis vulgaris*) is better adapted than any of the cultivated grasses to moist lands. It may be overflowed all winter, and is, consequently, a fitting grass for our ice ponds, which are kept dry during other seasons. Orchard grass is suited to land shaded by trees, and is sown by some farmers for making hay. It is fine for milch cows. In the spring, it furnishes good grazing before other grasses. Lucerne is a valuable grass, and bears more frequent cuttings than any other. It must be sown in drills 3 feet apart, and cultivated. The most economical mode of raising it, is to cultivate beets or some other cleasing crop between the rows of lucerne, and thus cultivate both at the same time.

5. The next subject of inquiry, the least injurious mode of grazing, has been in some measure anticipated in the foregoing remarks. The system least injurious to the land must be that which deprives it in the least degree of the vegetable matter necessary for its fertilization. After the second year's growth of clover has fully matured, a very small portion of its fertilizing qualities is abstracted by the grazing of cattle, which eat the tender shoots, but trample to the ground the principal growth; and the hoof seems beneficial in compacting the soil, which has become loosened by the vigorous roots of the clover. When corn is cultivated on clover land, it is necessary to graze it in order to prevent or mitigate the depredation of the grub worm, which otherwise abounds to the great deterioration of the crop. Where a plantation is cultivated in these fields, provision for stock should be secured in lots of clover, or of rye and clover, to be grazed successively until such times as would not be injurious to the clover fields. Where there are four fields, the stock are turned upon the third year's clover, which should furnish an abundant supply until after harvest, when they may feed as above stated, on the growth of the second year. A *standing*, or permanent pasture cannot be reprobated in terms too strong. It is alike ruinous to land and stock. The few who possess the advantage of firm marshes, have a ready resource when it would be injurious to turn stock upon their grass fields.

The advantages of meadows are very little appreciated by eastern Virginians. It is most discreditable, that we do not make hay sufficient to supply the wants of our own population. It is imported annually from the north, and even our farmers sometimes buy imported hay.* We can employ a portion of our land in no tillage more beneficial or profitable. It is capital bearing a very high annual interest. A good meadow will produce every year a crop more valuable than any of the cereal crops; and, moreover, these are liable to many vicissitudes in such land as is well adapted to timothy and herds-grass. There are very few farms which have not a few acres of this description of land.

It being the general opinion (an opinion, however, which may well be controverted) that meadows yield large crops of corn, they are frequently planted with this grain, the cultivation of which is cleansing, and thus well fitted to prepare the soil for the reception of grass seeds. Beds for hay should have the width of two corn rows—10 or 11 feet—the single row being inconvenient in mowing. To prepare a meadow, two rows of corn may be cultivated on this wide bed. But where the meadow has been, by no previous design, prepared for sowing grass seeds, and the corn crop has been cultivated in the usual way, the crop should be cut off early in September, (the corn, it will be soft, may be used for fattening hogs,) the beds ploughed double with a good rise in the centre to prevent water from settling thereon, harrowed, and reduced carefully to a fine tilth. Any degree of labor expended in executing this process thoroughly will be amply compensated. The seeds should be sown as soon as practicable.

The fitness of the soil for the sort of grass best adapted to it may be tested by a mixture of clover, timothy and herds-grass†—one third of each.

sowed it in the way here recommended. This and other successful results, induce him to believe that clover thus sown will succeed well after corn, it being sown as late in the summer as practicable. Wheat might then precede corn, instead of being followed by it, and both crops would be materially improved.

* Farmers' Register, vol. i. p. 134.

* There are a few honorable exceptions. The small counties of Elizabeth City and Essex are reported, in the late census, to have produced respectively, 1235 and 1466 tons of hay, Isle of Wight 20,000, (?) Nansemond 1989, Norfolk county 2500, Princess Anne 76,250, (?) Surry 1209, Stafford 2083.

† Dr. Archer condemns this mixture, because "the clover was ready for the scythe in May, the other two were not ripe for three or four weeks afterwards." He consequently lost the best part of his clover crop. His loss would have been diminished greatly, if not wholly avoided, by cutting his grass about a week later. The heaviest part of the first, and perhaps second crops, would consist in clover, and then the others will supersede it, and that best adapted to the soil will acquire the superiority. If any deem it presumptuous to differ from so experienced a farmer, let him follow the doctor's advice, and mix either timothy and herd's grass, or meadow oat and clover, which mature at the same time.

Two gallons to the acre will probably produce a good growth, but the sower had better sow double this quantity rather than fall below it. Thick sowing of meadows, in which weeds are commonly so prolific, is the best economy; and, besides stopping the growth of weeds, would insure a larger crop for the first cutting in the ensuing summer. Meadows are sometimes sown in the spring, but this season is not so favorable as the autumn, for a dry summer will be unfavorable to the young grass, the land is then more likely to produce weeds, farmers are commonly more busy, and the crop will not be fit for the scythe in less than 16 months. The meadow must be drained completely; no water should be permitted to remain on any part of it, and from time to time all bushes and noxious weeds should be extirpated. The bullrush is the worst pest. It is the offspring of superabundant moisture. It must be cut up by the roots, or it will soon acquire complete possession, the herds-grass, and all other grasses being unable to resist its vigorous encroachments. Besides extirpating the weeds, the meadow is best preserved by an occasional sprinkling, before the spring growth commences, of well-rotted stable manure. The Farmers' Register for May, page 200, tells us of a farmer in Massachusetts, who has four acres of *mowing ground*, which produces annually fully sixteen tons of hay. He uses plaster of Paris freely. We are not informed whether it is meadow or high land. Some recommend the use of plaster in what we usually term meadows, but the writer has no experience in this mode of application. Scarification of old meadows is recommended; but it must be a difficult process. I once made an unsuccessful attempt with a heavy iron-tooth harrow, which made scarcely an impression, the closely matted grass roots resisting an entrance. The process was attempted in order to level the single beds, on which the seeds had been sown erroneously, from want of experience and good counsel.

Hay-makers concur in recommending meadows to be mowed before the seeds are fully ripe. This period, in our latitude and elevation of country, is from the middle to the latter part of July. The modes of curing the hay are various. It is the most simple, economical, and an equally efficacious plan, to expose the grass to the sun so long as merely to dry it—to rake it into wind-rows in the latter part of the day on which it is cut—the following day, to put it into small cocks for curing, in two or three days to make other cocks by reducing two into one, forming it on intermediate ground, so as to remove and turn over each one. And as early afterwards as is convenient, to haul it to be stacked or ricked. In good weather, the hay is, by this method, cured with good fresh color and sweet flavor, and is pliant and yielding, not crisp and hard, as when it is too much cured by long exposure to the sun. If interrupted by rains or showery weather, more labor is required in drying the grass so as to prevent mildew. If it is put up wet, it will heat quickly even in small cocks; hence, constant vigilance is necessary in securing it from excessive dampness, and it must be completely dry when taken to be stacked. It is a safe precaution to throw open in the morning as many cocks as shall be hauled to the stack during the day.

Meadows of good quality, well drained, well preserved, and manured occasionally, will produce annually from one and a half to two tons of hay per acre. One ton and a half are worth not less than $22 50, sometimes $30, equal to the value of from seven to ten barrels of corn every year—a product which few, if any, meadows will average for a series of years.

Lastly, the second growth of the meadow, termed the aftermath, furnishes excellent grazing for beeves in the fall of the year. When winter, dreary winter, follows in its turn, the cow, the ox, the horse, will render a daily tribute of thanks and service to a provident master, for the liberal provision yielded by his meadow; and the master, when the well-fatted, finely-marbled round adorns his board, will renew his acknowledgments for the bounties of a gracious GOD, who provides so plentifully for the wants of man.

E. T. T.

King George, July, 1842.

MARLING IN SOUTH CAROLINA.

To the Editor of the Farmers' Register.

* * * I am still pressing on with the marl, and have collected on my bluff, since I planted my crop, some 25,000 bushels, and am still bringing up 2400 bushels per week; I shall begin to haul it out as soon as I gather fodder. The forwardness of cotton will interfere with me some, as I shall have little or no time between gathering fodder and commencing to pick, but I am resolved to have between 600 and 700 acres marled for the next crop. The land marled this year shows the effects very plainly, and that marled earliest shows best, which gives me faith in its continuing to improve. I think, as thinks every one, that the effect *this year* is fully equal to a fair coat of our stable manure. Both the corn and cotton marled are also in advance of earlier plantings, apparently a week or 10 days now. I find that some bald places have been injured, but, to counterbalance, low wet places which I thought too wet for marl, have proved to have been only too sour heretofore, and are bearing finely. My experimental acres in corn will afford a pretty fair test, but not in cotton. It turns out that the acres without marl and with the 300 bushels of marl were far superior in point of soil to those with the 100 and 200 bushels. I was deceived by the stalks of cotton. The last year being a very peculiar one, the poorer acres produced as well as the best. In addition to this, the marled land being slower to come up, my overseer planted it all over again. The acre unmarled vegetated earliest, and was only replanted; half of it is 10 days or more older than the others. On the whole, however, I am fully satisfied, and if it goes on as it now promises, I shall go on until I marl all my planting land. My people all say the marl has very much improved the land for working. The stiff parts are mellowed, and the light made more consistent. They say, too, that they can work the nut-grass better, and kill more of it. This terrible nuisance made its appearance a few years ago on my place. I have done nothing to arrest it, for I

have never known any thing to avail. Do you suppose marl can have any effect on it? Possibly it is an acid grass, and, like sorrel, may be rooted out by alkalies. * * * * *

[We have heretofore, on several occasions, remarked upon the absence of all effort to improve by marling in South Carolina; and afterwards welcomed the news of the earliest movements towards that great and beneficial work. We rejoice now to learn that, at least on one large plantation, marling is in that state of progress, and has been already so successful in profitable effects, as to leave no doubt of there being now fairly commenced such operations as will soon make South Carolina a marling country. In this great "internal improvement" of that state, (more valuable for private profit, and for augmenting the public wealth, than all her great and costly improvements for transportation, on rail-roads and by navigation,) the writer of the private letter from which we have taken the liberty of extracting for publication the foregoing passage will be one of those pioneers who will render the greatest service to his countrymen, by practically showing to them the way to improve and reap rich profits from their great and almost totally neglected natural resources. In consideration of our object, to make his example more profitable to others, we trust that he will excuse this use made of a portion of the last received of his several private letters, written to obtain information for his own guidance in marling. We cannot presume farther, and point out the writer or his locality more distinctly. But we may say to those of his countrymen who can use marl, and have not done so—"Seek out for the most extensive and successful marling operations now in progress in South Carolina—see them and judge for yourself, and then act according to your judgment of the proofs of success and profit." It is true, and lamentable, that all that is said, written, or published to urge to this or any other novel improvement in agriculture, has scarcely any effect, even on those who hear and read all the facts and reasoning. But exhibit the same truths to the eyes of the same persons, and twenty of them will follow the example, where one would without such ocular proofs being presented. *We* have, in our way, by writing and publishing, done very far more than our correspondent to instruct his countrymen, as he has been instructed, and almost to no purpose; but his practice will do what our precepts have failed to effect in every particular, except on himself and perhaps a few others. May he effectually do this good work, in which we have, for his state, and so far, signally failed.—Ed. F. R.

VALUE OF IMPORTS AND EXPORTS, &c., FROM 1821 TO 1841.

From the Philadelphia Public Ledger.

The annexed tables, showing the value of imports and exports annually, from 1821 to 1841 inclusive—the receipts into the treasury, annually, from customs, during the same period—and the value of bullion and specie imported and exported—was communicated to Congress on the 17th ultimo, having been prepared by the Register of the Treasury, in compliance with a resolution of the House of Representatives.

VALUE OF IMPORTS.

Year.	Free of duty.	Paying duty.	Total.
1821	$10,082.313	$52.503.411	$62,585,724
1822	7,298,708	75,942,833	83,241,541
1823	9.048 288	68,530 979	77,579,267
1824	12,563,773	67,985,234	80,549,207
1825	10.947.510	85,392.565	96,340,075
1826	12,567,769	72,406,708	84,974,477
1827	11,855,104	67 628.964	79,484.068
1828	12.379.176	76.130.648	88,509,824
1829	11,805 501	62.687.026	74.492,527
1830	12,746.245	58.130 675	70,876,920
1831	13,456,625	89.734.499	103,191.124
1832	14.247,453	86.779.813	101.029,266
1833	32,147.950	75,670,361	108,118.311
1834	68.393,180	58,128,152	126.521,332
1835	77,940,493	71 955.249	149.895.742
1836	92,056.481	97,923,554	189,980.035
1837	69.250.031	71,739,186	140 989,217
1838	60,860 005	52 857,399	113,717.404
1839	76,401,792	85.690.340	162,092,132
1840	57,196 204	49.945,315	107,141,519
1841	66,019,731	61,925,757	127,945,488

VALUE OF EXPORTS.

Year.	Foreign Merchandise.	Domestic Produce, &c.	Total.
1821	$21,302 488	$43,671,894	$64,974,382
1822	22.286,202	49,878,079	72,160.281
1823	27 543,622	47,155,408	74,699,030
1824	25.337,157	53,649 500	75 986.657
1825	32,590 643	66,944,745	99 535 388
1826	24 539 612	53,055.710	77,595 322
1827	23,403.136	58,921.691	82 324.827
1828	21,595 017	50,669.669	72 264.686
1829	16.658,478	55,700.193	72 358.671
1830	14.387.479	59,462 029	73.849 508
1831	20 033 526	61 277 057	81.310.583
1832	24.039,473	63,137,470	87,176,943
1833	19.822.735	70,317.698	90.140 433
1834	23 312,811	81.024,162	104 336 973
1835	20,504.495	101,189,082	121 693,577
1836	21,746 360	106.916,680	128.663 040
1837	21,854.962	95,564,414	117,419 376
1838	12.452,795	96,033,821	108,486,616
1839	17,494.525	103,533.891	121,028,416
1840	18,190,312	113,895,634	131.571.956
1841	15,469.081	106,382,722	121,851,803

	RECEIPTS INTO THE TREASURY.	BULLION AND SPECIE.	
Year.		Imported.	Exported.
1821	$13,004,447	$8,064 890	$10,478.659
1822	17,589,762	3,369,846	10,810,180
1823	19,088,433	5,097,896	6,372,987
1824	17,878,326	8,379,835	7,014,552
1825	20,098,713	6,150.765	8,470,534
1826	23.341,332	6,880,956	4,704,236
1827	19,712,283	8,151,130	8,014,880
1828	23,205,524	7,489,741	8,243,476
1829	22,681,966	7.403,612	4,924,020
1830	21,922,391	8,155,964	2,178,773
1831	21,224,442	7,305,945	9 014,931
1832	28,465,237	5,907,504	5,656,340
1833	29,032,509	7,070,368	2,611,701
1834	16,214,957	17.911.632	2,076,758
1835	19,391 311	13,131,447	6.477,775
1836	23,409,941	13,400,881	4,324,336
1837	11,169,290	10,516,414	5.976,249
1838	16,158,800	17,747,116	3,508,046
1839	23,137,925	5,595,176	8,776,743
1840	13,499,502	8,882,813	8,417,014
1841	14,487,216	4,975,883	10,034,332

Estimate.—It has been estimated by some that there was of specie and bullion in the country on the 30th September, 1820, - - $18,000,000

But say - - - - -	20,000,000
Imported from 1821 to 1841, -	181,589,841
	201,589,841
Deduct exported from 1821 to 1841,	138,085,922
Balance, - - - - - -	63,503,919

SEASON AND CROPS.

The clear weather mentioned in our notice of last month continued but three days, (which however was the salvation of the greater part of the wheat crops,) after which rains recommenced and continued every day, for the greater part of July. This remarkable continuance of rains, increased the previous damage of the wheat crop, and lasted through the oat harvest, to the great injury of that crop. The corn crops have suffered every where from the ground continuing too wet to be worked, and especially on all level lands, where much of the growth has been water-soaked until destroyed.

The continued and heavy rains have caused the rivers to flood their low lands. Great damage has thus been caused to the growing crops of corn and tobacco, and still more to the wheat in shocks. James river, at Richmond and above to Lynchburg, was higher than has occurred since 1795, and the damage to crops on all those extensive and rich low grounds has been enormous.

The weather and earth now dry, and rain is wanting.

July 29.

With this number will commence the publication of a new and enlarged edition of the 'Essay on Calcareous Manures,' of which a portion will be issued with each succeeding number of the Farmers' Register. The pages of the Essay will be numbered separately, so as to be bound up together, either at the close of this volume, and as a part of it, or separately, if preferred. Either eight or sixteen pages, (on an average,) in addition to the usual sixty-four, will be given with each number while the publication of the Essay shall form a part. The twelve pages of title, table of contents, and introductory matter, which will stand first when the publication is completed, are as yet omitted, and will be supplied hereafter, when printed.

ERRATA.

In report on Brandon farms,

Page 281, column 1, lines 42 and 43, for "lbs. of butter," read *dollars' worth* of butter.

At page 277, erase the repetition of the sub-head, "*Preparation for and cultivation of corn.*"

In the editorial article, "Farming at Westover," in No. 4, at near end of page 171, there is an *incidental* reference to the crop of wheat of 1841, as amounting to 5000 bushels. This was an error, which Mr. Selden has since enabled the editor to correct. The crop referred to was not quite 4200 bushels. The mistake was not founded on any statement made by Mr. Selden, nor on any thing said on that occasion, but was caused by the editor's reliance on previously heard and common report, which he supposed undoubtedly correct.

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THE FARMERS' REGISTER.

VOL. X. AUGUST 31, 1842. No. 8.

EDMUND RUFFIN, EDITOR AND PROPRIETOR.

WINTER RYE FOR EARLY SPRING FEED.

From the New England Farmer.

The following article, which we copy from the Journal of the Royal Agricultural Society of England, is worthy of attention by many farmers in this country. The length of our winters, and the lateness of the season before our cows and young stock can get a good supply of feed from our pastures, render it very desirable to find some article which may answer for feeding or soiling earlier than any that is in general use among us. Rye is sometimes sown for feed, but when it looks well, the farmer is reluctant to turn in his cattle upon it. But its luxuriance would not be objected to by his stock, and he must get over his compunctions. Our Indian corn crop affords us an opportunity to resort to the rye more conveniently than the English farmer can. We can sow our seed at the last time of hoeing the corn, and the work is done. The great obstacle in the way here is, the fact that our corn in most cases covers only a part of the field, and we cannot feed the rye without turning other lands out to pasture also. With us, unless we go more extensively into the cultivation of turnips, or some other crop that can be sown later than we generally do, we must give up the land to the rye for an entire year. But we think this would be good husbandry for many farmers whose pastures are short.

The article below was based upon English soil and climate—but the necessary adaptations to our circumstances any farmer is competent to make.—ED. N. E. F.

ON EARLY SPRING FEED.

By Matthew M. Milbury.

The increased quantity of stock which the farmer is enabled to keep by the introduction and successful cultivation of green crops requires his best attention to furnish them with a constant supply of green food, especially such portion of his stock as are not intended for fattening. The use of the artificial grasses on arable land in summer, and of turnips in the winter, has been brought as near perfection as may be; but it is quite certain that the wants of the sheep and cattle, from the time when the turnips are consumed to that when the grasses become available, are not equally well provided for. In order, as far as possible, to remedy this deficiency, recourse has been had to the cultivation of turnips which long retain their nutritious qualities, and the Swede has been truly invaluable for this purpose. But while these roots have furnished very palatable and nutritious food for one portion of the stock, they have altogether failed for the young—the principal object of the breeder's anxiety. For as well as having an abundant flow of milk from the dam, every breeder is desirous of training the young stock to help themselves as soon as there is food of a proper quality available for them; and if the young lambs in particular are kept from green food until they are turned into the gross clover leys with their dams, there is great danger that a portion of them will be lost. It is generally desirable to keep the clover leys free at least until May, and long before that time the young stock should be trained to eat a considerable portion of green food.

With the view of supplying this want, several crops have been cultivated for early feed in the spring, with greater or less success, and under greater or less disadvantage, according to circumstances, but the farmer who occupies a poor soil is, more than any other, under the necessity of grappling with the difficulties he may have to contend with; for lateness of vegetation and certain destruction of his crops of grass are sure to be the consequence if he break into them before they attain a proper degree of maturation, and yet he has also the greatest difficulties to surmount in cultivating any spring crop.

The farmer, on the other hand, who cultivates rich fertile land, where he has a deep alluvial soil, growing every crop luxuriantly, can easily free a pasture early in the autumn, and have it full of young grass as early as he may require it, and knows nothing of the difficulties which attend his less favored neighbor.

The avidity with which any new variety of grass or plant promising early growth is tried, indicates how desirable a point it is to secure an early supply of succulent food. At one time it was hoped that this desideratum was discovered in the crimson trefoil.

The winter tare is one of the most valable esculents for stock in possession of the cultivator, and affords the greatest bulk of nutriment of any cultivated green crop, turnips perhaps excepted, and is relished at all seasons and by every kind of stock. It is sometimes resorted to for depasturation in the spring, with a view to subsequent soiling, but it is after all rather a *summer* than a *spring* crop; and it is more than problematical that the injury done to the crop by spring feeding upon it is greater than the amount of spring food thus obtained. If it be worth while to have a supply of early feed, it is worth while clearly to provide a crop specially for that purpose. As a *spring* crop, according to the writer's observation and experience, it is decidedly inferior to other cultivated plants.

The writer of this paper has seen rye-grass very successfully cultivated as early spring feed sown alone. It requires to be sown a whole year before it is fit to consume, and thus lies open to the objection of interfering with good husbandry, particularly the hoeing of the corn crop, with which it is sown a whole year before, as well as preventing the ploughing of the land for the same period; thus encouraging the growth of quitch and weeds, while the adhesion of the soil which it produces, and the accumulation of roots, &c., very materially prevent its kindly working for the crop intended to follow.

The above remarks are made on the supposition that the rye grass is introduced as a half crop, for it must be quite clear to every practical farmer that there is no sound practice in throwing away a whole year's crop for the sake of one month's feed

in the spring, valuable as it undoubtedly is. The trials above mentioned which the writer has seen, have been with Pacey's rye grass, and though the Italian rye grass would furnish a greater portion of food, supposing it tillered as much as Pacey's, which is not the case, yet it is liable to all the above objections, and from the observations of the writer it appears exceedingly doubtful whether it will bear an equal degree of frost to Pacey's.

It is the intention of the writer now to state his experience, and offer his recommendation of a crop embracing all the advantages of the preceding, and several peculiar to itself. It is that of *rye*, eaten in the early stages of its growth. It is intended to intervene between the last crop of the four-course system, which is generally wheat, and to be eaten, and the land ploughed and worked for a crop of turnips. It is equally applicable to all kinds of rotations, and would well precede a fallow or a crop of rape. As it is generally upon farms where the four-course system is pursued that spring feed is most wanted, the writer will confine his observations to that rotation.

So soon as the wheat is cut in the autumn, the plough should be set to work. This may be done even before it is carted, during the mornings of harvest. A single ploughing is given, and a very slight dressing of any kind of short manure. In some cases where the farmer lays on his manure in the autumn, for turnips the ensuing year, it might be better to lay it on before the ploughing. It should be remembered that the slight dressing should not all be considered as given to the rye; in reality it becomes incorporated with the soil, and more intimately mixed with it than by the ordinary mode of spreading it on in the autumn, and any part of it which the rye may abstract, will be more than compensated by the droppings of the stock and the carbonic acid gas which they evolve while consuming it; and which the soil more readily absorbs in the spring than in any other part of the year, evaporation going on at that period to a much smaller extent than in any other.

The seed must be sown upon the plough-seam broadcast, at the rate of 2½ bushels per acre, and if of that year's growth, so much the better, as it is earlier and more certain of germination. To this a peck of rape seed per acre should be added; for although the latter is not able to stand a winter when the frost sets in early and severe, in many cases it will get sufficiently vigorous to resist any ordinary frost, and will much improve the feed in the spring. Should the rape not be sown, a peck of winter-tares per acre will improve the feed, or an additional peck of rye may be added; as a fuller bite and excited growth in its early stages will be secured—a point gained when wanted to depasture, although it might be injurious if sown for a crop.

In cultivating rye as feed there need be no fears entertained of its becoming "winter proud," for as that only affects the ears of the corn, it is a circumstance of no importance, and therefore the earlier it is sown the better able it is to resist the early frosts, as well as having a better cover and more feed when wanted. When sown it should be thoroughly harrowed, but not rolled—a *double* with a pair of fine harrows is sufficient, and the surface weeds should be gathered off, or the whole raked with the hand, which will more efficiently cover the seed. An advantage is gained to the soil by this plowing, which cannot be obtained when the land is sown with the vetches. The annual weeds on the old surface are prevented from running to seed, and a new surface is exposed to the air and frost.

The rye will be fit for consuming the last week in March or the first in April, or if allowed to remain until the middle of the latter month, it will carry a greater quantity of stock. After it is thoroughly eaten up, it should be freed, and by the first week in May, will afford another pasture of fine young nutritious feed; at least, in ordinary seasons. It is bad management, though sometimes practised, to allow the rye to remain uneaten until the seed-stalk begins to shoot, for in that case it will become much less palatable and useful. By consuming it young, it is much more valuable, and the succession crop equally so as the first.

The second crop being consumed, the plough must be put into operation, and the soil prepared for the succeeding crop; and the advantage of its cultivation, by no means a small one, is, that it interferes with no other crop.

Perhaps a short digression may be pardoned on the subsequent preparation of the soil. The writer's practice is different to that of most other persons. Usually it is cross-ploughed a fortnight after its first ploughing. Time is thus lost, and the slices are cut into squares difficult to be acted upon by the harrow. The writer begins to harrow as soon as the newly turned up surface of the first ploughing is sufficiently dry. This brings up the lowest part of the roots of the weeds and closes the interstices of the furrows, so that the remains of vegetation being covered, deprived of air, and gathering moisture, begin to decompose. Instead of cross-ploughing, it is again ploughed lengthways, and the old surface again brought up and harrowed. The weeds separate much more easily by this process, and much time and labor is saved; the same practice is applied to bastard fallows with the same good effects.

Rye has the decided advantage of being capable of resisting *any conceivable* degree of frost, and when even the hardy wheat is carried off by an ungenial season, it will escape injury, and even thrive. At this time (Feb. 21, 1840) the writer has a plot growing for feed which would now afford more eating than almost any mixture of artificial grasses in the middle of April, and that on a thin light soil not worth more to rent than 25*s.* per acre. Some of the rape has succeeded, even in this season of incessant rain, which prevailed not only in the early stages of its growth, but ever since it was sown. It can bear so much and constant wet, worse even than frost.

The expense of this crop will be somewhere as under. Say per acre—

2½ bushels of rye at 4*s.* 6*d.*	11*s.* 3*d.*
½ peck of rape,	0 10½
	12 1½

It should be remembered that this interferes with no operation of husbandry, and prevents no crop, so that no rent of land or other extras are to be reckoned—the ploughings would be nearly the same if the rye were not sown. Nothing is better relished by stock at the season when it is intended to be used; a guide by no means unsafe as to its nutritious qualities, and which is borne out by the condition of the stock feeding on it.

To recapitulate the advantages of its cultivation:

1. Provision of excellent green food is made at a season of the year when of all others it is most wanted.

2. It is produced without sacrificing any portion of the usual rotations pursued on a farm, and with little extra labor, nor does it interfere with the management of any preceding or succeeding crops.

3. It will grow on any soil, but is especially calculated for poor loose sand, when every other green esculent is more or less uncertain.

4. It will bear any degree of frost to which our climate is subject, and is sufficiently hardy to defy the effects of the coldest situations in the country, being there cultivated instead of wheat for a corn crop from necessity.

5. It is as inexpensive, or more so than any grass or leguminous plant.

6. It is readily consumed by stock, especially young animals.

7. It improves rather than deteriorates the soil upon which it is grown.

Thorpfield, near Thirsk, Yorkshire.

THE WILD HOGS OF THE NORTHERN PARISHES OF LOUISIANA.

From the Western Farmer and Gardener.

Dear sir—Presuming a short account of *hogy-ology*, (if I may be allowed to coin a word,) in the swamps of Louisiana, may not be entirely unacceptable to some of your numerous readers, I have concluded to scribble you a few lines on that subject. The settlements on the level or low lands are usually along the margins of rivers, lakes and bayous, there usually being a belt of land from a quarter of a mile to two miles in breadth, which is arable and rarely subject to overflows; as you recede from these into the still lower lands that are almost annually inundated, you find yourself (unless during a flood of the "Great Father of Waters") in open woods entirely clear of bog or morass, occasionally checkered, here and there, with a cane brake on the most elevated spots, and then again with palmetto, sometimes in small patches, and again extending for miles, varying in height from two to eight feet on the lowest parts of the swamp. The timber in these lowlands is composed of fifteen varieties of oak, swamp-hickory, persimmon of two varieties, pecan, &c., some of which rarely ever fail in producing an abundant mast. On the most elevated ridges we have a variety of grape vines, bamboo, two species of the vine producing the trumpet-flower, the green-brier, and many other kinds of vines that entwine their pliant folds around every tree within their reach, and render the spot entirely impenetrable to a horseman. In the open parts of the swamp (for in the south all land is called swamp that is or ever has been subject to overflow) where the timber is scattering, there are several varieties of the grapes which are peculiar to these swamps, and also many weeds and flowers that are in bloom during the winter months. These low lands are not arable, and never will be, as the lowest of them are the reservoirs not only of the Mississippi floods, but are also the receptacles for the overflows of the Arkansas, the Onachitta and Red river—the breadth of these inundated lands is from 10 to 40 miles. Here then is our wild hog range.

The wild hogs are usually three or four years in coming to maturity, and frequently weigh from two to three hundred pounds, gross; their color is various: black, white, sandy and pale red, and every variety of mixture which these colors will admit of; their form is ordinary, having rather too much leg, which makes them quite *heely* at times; rather slab-sided, with a roached back, well set off with long stiff bristles, which, when elevated in battle array, give them quite a formidable appearance; there is, however, much variety in the form and size of these hogs, as they are crossed and recrossed by new recruits which stray off to them in search of mast, or fall in company with them in their rambles near the plantations; hence you occasionally see some of them that might pass for a distant relation to a Berkshire, and again you come across one whose whiteness, and whose rounded hams would say that some of his ancestors had had a letter of introduction to a grazier from the land of St. Patrick. The wild hogs subsist on a great variety of food; in the fall and winter months they fare sumptuously on the great variety of mast which the oaks, persimmons, hackberries, pecan and palmetto yield, together with the grape that contributes its beautiful clusters in great profusion. In the spring and early in the summer months their fare is frequently scarce, and they are frequently driven by high water and hemmed up on the more elevated parts of the swamp, that are covered with cane; they then subsist on young cane roots, the roots of the blackberry, or dewberry, and the wild potato —at this season they usually become quite poor. As the water subsides they fare very sumptuously on fish of every description that have been entangled in the vines, thickets, and cane brakes by the sudden falling of the water. Shell fish of various kinds, such as the loggerheaded turtle, the soft shell, the common terrapin, craw-fish, and shrimps add to their bill of fare, and make up quite a variety of fishy food.

The wild hogs usually feed in the day-time, unless they are frequently hunted, in which case they feed in the night, and conceal themselves during the day in brier thickets, cane brakes, and sometimes in large hollow trees and logs, which are favorite haunts for them in the winter months.

They usually live together in small numbers —sometimes as many as fifteen or twenty old hogs, with their yearling shoats and pigs, generally numbering sufficiently strong to repel the assaults of the wolves, which are very numerous, and in consequence of their numbers, their most troublesome enemies. The wolves never attack them openly and boldly, but follow after them, and conceal themselves until a favorable opportunity occurs; then they seize a pig or shoat that has carelessly strayed at some distance from the old hogs; for at the first squeal, the old hogs make a furious charge, en masse, while the young cluster in the rear, until their enemies have been beaten off, when they all retreat at the first favorable opportunity. Their sense of smell is much more acute than any person would suppose, who has been acquainted with his swineship in a domestic state only. They can smell a man, who happens to be to the windward of them some one or two hundred yards, when there

is any current in the atmosphere; and when they are feeding in the open woods, they are generally on the "qui vive." And in passing, let me say that these long-faced gentry have not had their eyes stuck above their lantern jaws to no purpose. Their senses of smelling and seeing are acute, and hence a still damp day is usually selected for hog hunting. They often display a good deal of cunning in concealing themselves; for when in the thickets or cane brakes, they will squat, and you may ride within thirty feet of them; and if neither the hunter nor dogs discover them, they will lie close to the ground, until they think they have been discovered, or until their pursuers have passed by. It is common for deer, similarly situated to do the same.

The month of January is the most usual time for hunting the wild hog, as he is usually fatter at that season than at any other time of the year; and the weather being cooler, is better adapted to preserving his flesh. Hounds are occasionally brought in requisition in hunting these animals, but they are objectionable, as their noise gives the hogs early notice of the approach of the hunters; and taking the advantage of such a start, it is difficult to overtake them, as they are equal to a four mile horse in a long-winded chase, particularly if the chase happens to be through heavy cane-brakes, green-brier thickets, and cypress ponds, and these are favorite retreats.

The dogs most suitable for hunting wild hogs are able-bodied, active curs, that take the trail, and follow it up silently, until they come up with the hogs, when they bring them to a bay by barking at them; and if they do not stop, they seize one, which immediately causes them to "*rally*," when the dogs in turn retreat a short distance, separate, and by occasionally seizing and again retreating and barking, they occupy the attention of the hogs until the hunters have time to ride up, select each one the largest hog, and shoot them down, at which time the hogs make an attempt to escape, but the dogs again overhaul them, and again the hunters thin out their numbers, until they have killed as many as they can conveniently manage, when they return home; and the remainder of the "gang" make their way to other neighborhoods, but usually return in the course of a few days to their wonted range, and again, at a suitable time, encounter the same scenes of extermination.

Hog hunters usually shoot off of their horses, if the woods are sufficiently open to admit of it, as it is occasionally dangerous to approach on foot; in fact, horses are sometimes crippled by these hogs, for an old wild boar is as furious and dangerous as a bear, particularly if he has been shot at and crippled, and been much harassed by the dogs.

The wild hogs of the swamps, although they cost neither care nor cash, are a great pest to the planters, for by frequenting the range of the gentle hogs, they soon impart their wild nature to them, and if they are not closely attended to, they soon quit the plantation, to return no more.

The Berkshire and Grazier are destined ere long to supplant these worthless creatures, that require more labor to hunt them than they are worth. We are getting wide awake on the subject of hogs, and we will not desist till we have stocked our range with the broad backed Berkshire. Respectfully,

HENRY J. PECK.

Sicily Island, La., May 1st, 1842.

VARIOUS KINDS OF FORAGE CROPS.

Translated from "Le Bon Jardinier" for the Farmers' Register.

Bunias d'Orient, Rocket, Bunias orientalis.—The want which we have experienced, in our agriculture, of a green food in March and April, has directed attention to the rocket. Thounin and Arthur Young have recommended it on this account, as well as for its abundance and good quality. I have observed it in gardens in full vegetation in March, and exceedingly foraginous. But M. Charles Pictet, of Geneva has informed me that the rocket placed in the fields has not answered his expectation; in like experiments I have not found it more early, but perhaps less so in the commencement of spring than the wild chickory, but in April it affords a very vigorous vegetation and an abundant pasturage. In 1818 it exhibited a very valuable quality, that of resisting entirely a severe drought. More frequent experiments with this plant would be quite interesting. In small attempts the rocket should be sown in plant beds, and from thence planted at eight or ten inches apart. If its culture is extended, it may without doubt be sown with success where it is to remain, for it will even reproduce itself by its seed. It is a plant of considerable longevity.

Chickorée sauvage, Wild chickory, Cichorium intylus.—A productive and early grass, well calculated to withstand a drought; very useful as pasturage or to be given green in the stable; it is excellent for cattle, sown half and half with red clover; it will succeed well in stiff or light lands, provided there is some depth of soil. It is generally sown in the spring, broadcast, either alone or with barley or oats, at the rate of 24 pounds to the hectare. It may be sown in September. It lasts three or four years. A variety, the *Chickorée sauvage à café*, has long thick roots like the white carrot. They use it in the manufacture of chickory coffee, but advantage is also derived from it as a food for beasts, particularly hogs, which eat heartily of the roots, more hard and fibrous than those of the ordinary variety. The roots do not freeze, and will resist the winter in the ground, which is important; the plant is also more vigorous, and the leaves larger than those of the common wild chickory, and it is probably as a forage not inferior to it. Sown a little thin, it furnishes excellent roots, and may be cultivated with the spade and hoe.

Chou à vaches, [*Cow*] *Cabbage, Brassica oleracea vaccina.*—Every where is the utility of the cabbage as food for cattle known; but it is only in some locations that it is planted solely for that purpose, for which it deserves to be more generally used. Among the varieties which are fitted for it, the *chou à vaches* appears to be the best, at least for fertile lands, on account of its considerable height and the size of its leaves. They cultivate it extensively in the most of our western departments. All cabbages prefer a good soil, rather stiff than light, and well manured. They sow the *chou*

à vaches, and the other large varieties, in plant-beds in March and April, or in July and August, they replant them where they have attained sufficient size, the first of April or May, the second from September to November, in rows about three feet apart, and between two and three feet distant in the row, the space varying with the variety and the fertility of the soil. Whilst they are growing the ground is kept clean with the hoe. The cabbage yields its product of leaves in the spring of their second year from being sown. The *caulet* of Flanders, cultivated chiefly in the environs of Lille, is very similar in its appearance, its height, and its product to the chou à vaches. The *chou branchée* or *mille-têtes* of Poitou is the variety which they prefer to cultivate about Chollet for the fattening of cattle; it is less tall than the *chou à vaches*, but it is at least as productive; it is furnished from the foot with numerous strong shoots, which give it very much the appearance of a thick shrub.

The *chou vivace* of Daubenton is like the preceding, but its lateral stalks, more particularly those situated near the lower part of the trunk, grow to a considerable length, and often bend themselves and form an elbow on the ground, where it puts out roots. This has caused Daubenton to call it *chou de bouture*, (the cabbage of suckers.) It stands the winter's cold very well, and was one of the few varieties which supported the severity of 1830. These different varieties, with all those that may be properly called green cabbages, are cultivated all in the same manner, and are but little sensible to the cold. Six or eight ounces of seed will furnish enough plants to set out an acre.

Chou arbre de Laponie.—M. Madiot, director of the gardens at Lyons, has recommended under this name a cabbage which he says will last 8 or 10 years, resist all extremities of cold, and yield a great quantity of produce. In many comparative experiments, this variety has appeared so much to resemble the *chou a vaches* that we think it cannot be distinguished from it. The winter of 1830-31 destroyed both.

Chou frisé vert du nord, and *Chou frisé rouge du nord*, *Brassica oleracea fimbriata.* These two varieties are very much cultivated in the north of Europe. They differ from the preceding varieties, in having their leaves pinnatifid, which renders them less productive. But they have in their favor the advantage of being much more hardy. The winters of 1830 and 1832, present a remarkable proof of this fact; they supported them almost without any alteration, (the *frisé rouge* especially,) whilst the *chou à vaches* and the Poitou, and most others were destroyed.

Chou-navet, *Chou-turnep*, *Chou de Laponie*, *Brassica*, *Napo-brassica.*—Its produce consists chiefly in its plump root, which is like the turnip, and one of its most valuable qualities is that it resists the cold almost entirely. They usually cultivate it in the same manner that they do the other kinds, with the difference that it is better to place the plants nearer together. They also obtain very fine roots by sowing them where they are to stand, either in rows (which is the best way,) or broadcast.

In either case they sow them so that they may be thinned, leaving the plants about twelve inches apart. It should be sown at any time from April to June, at about 4 pounds of seed to the hectare.

Chou ruta baga, *Navet de Suéde*, *Brassica.*—This plant, introduced into France in 1792, was known in England a few years before, where it is now most extensively cultivated. It resembles very much the *chou navet*, with which M. Sonnini has *mal-à propos* confounded it, for they are entirely distinct plants. The ruta baga can be transplanted, but it is best to sow it where it is to stand, (or rather to grow.) It is best to sow it in rows, and to let it have the same space with the *chou navet*. It attains maturity more rapidly than that, and is about one month more early. Both accommodate themselves better than the large cabbages to light and indifferent lands, but they prefer them good and manured. The ruta baga will resist much cold, and may be kept in the fields during the winter, to be taken up only when there is need for them, but I have frequently remarked, that great humidity and alternate freezing and thawing, was more injurious to them than to the *chou navet*, this defect, however, is counterbalanced by the beauty and neatness of its roots. Both afford valuable resources for food for horned cattle and sheep, to which they are given when cut up. The *chou-navet*, and the large cabbages are cultivated still in some counties as food for cattle.

Chou colza, *Brassica oleracea campestris.*—It is chiefly for the oil which is obtained from its grain that the *chou colza* is cultivated. This oil is a great object of commerce in Flanders, Belgium, &c., but it answers also for food for cattle. For this use it may be transplanted into rows as the other green cabbages; but the best manner appears to me to be that adopted by M. Yvart, which is to work the stubble fields immediately after harvest, with a plough or heavy harrow, and then to sow the seed at about ten pounds to the hectare. This plant will get through an ordinary winter without damage, and will, at the end of that time, furnish either pasturage or food to be fed away green in the stable, both of which will be valuable from the season at which they come in. All of the hardy cabbages, and still better the ruta baga and the *chou navet*, can be thus used; the only particular advantage that the colza has in this respect is the small expense at which the seed may be obtained.

Cultivation of the colza for grain.—The method above described is only proper when the colza is to be used as green food in the spring; when cultivated for the grain more care is necessary. From the middle of July to the last of August, they sow it in beds well prepared, and in six or eight months they transplant the young plants into ground equally well prepared and manured, placing them one foot apart each way. They plant them thus on beds of twelve feet in width, leaving between these beds intervals of two or three feet unplanted, from which intervals earth is obtained later in the season, to place about the feet of the plants. If one desires to work between the rows with the cultivator or skimmer, it is necessary to increase the distance to eighteen inches or two feet. It is essential to gather the seed so soon as a large majority of the pods have attained almost to maturity, else great loss will be experienced by shattering. Sometimes the colza is sown, where it is to stand, broadcast; but it is then necessary to thin them with the hoe. What I have said is applicable to the common winter

colza. There is a spring variety, the *colza de Mars*, which, sown in March and April, ripens during the same summer, a quality very remarkable in a cabbage. This variety is not so much in cultivation as the common kind.

Millefeuille, Milfoil, Achillea millefolium.—This plant, being little productive, and not calculated for the sickle, has only a secondary rank in the list of plants for forage, yet under certain circumstances it can be rendered extremely useful. It affords good pasturage for sheep, and has the merit of withstanding the effect of a drought, even on the most arid lands. It is extremely probable that proprietors of sheep, particularly in the middle of France, would find in the culture of the milfoil a valuable resource for food for their cattle in the summer months. This plant is long-lived. It should be sown in the spring, but will, without doubt, succeed if sown early in autumn. It grows more commonly in the hard and dry clay lands, than on those which are of a light and sandy nature. From ten to twelve pounds of seed to the hectare.

Moutarde noire, Black mustard, Sinapis nigra, and *Moutarde blanche, White mustard, Sinapis alba,* are cultivated chiefly for the seed, of which is made the condiment of the same name. They sow it, however, (particularly the white,) to furnish green food to the cows for the end of summer. For the first purpose, they select good, deep, fresh land, and sow it rather thin in the spring. For the second, the white mustard is preferred, and they esteem it so much that in many cantons it is called *plante de beurre*, (butter plant.) The usual mode of treatment is to sow it on the stubble fields immediately after the harvest, having first given it a slight working by means of scarifying it with a harrow. This seed, if the season is favorable, grows rapidly, and affords food for the cattle until the cold weather sets in.

Navette, Rabethe, Rape, Brassica, Napus silvestris, serves for forage when sown on the stubble lands after harvest, at the rate of twenty pounds of seed to the hectare. We know some farmers who for this purpose prefer it to the white mustard; but its chief value is its oleaginous grain. For this object they sow it from the last of July to the first of September, generally broadcast, on land prepared by many workings. They sometimes sow it in rows; they work it, or rather weed it, and thin the plants. The ensuing summer they gather the grain when the larger proportion of the pods is yellow, but before it is completely mature, for then there will be a considerable shattering. The variety which is thus cultivated is the common or winter rape. There is a kind called the *navette d'eté*, or *quarantaine*, which is sown in the spring, and matures itself the same year. It is less productive than the ordinary variety, but it presents the advantage of supplying the place of the other oleaginous plants, should they be destroyed by the winter's frosts. They sow about six pounds of the seed of the winter, and eight pounds of the summer rape to the hectare.

Pastel, Woad, Isatis tinctoria, considered as a plant for forage, is valuable only on account of its extreme precocity. Winter only arrests its vegetation during periods of the severest cold, and in March, and sometimes February, it is considerably developed. If it were more sought after by the cattle it would be one of the most valuable resources of the farmer; but, unfortunately, it is wanting in this respect. I do not think, however, that this point has been sufficiently examined into. I know of no attempt with the woad to nourish horned cattle during the winter, and the authorities both for and against its fitness for sheep are nicely balanced. I think therefore that new researches into this subject would be highly useful. We should not renounce the advantages which the winter vegetation of the woad offers, without an entire conviction of its inutility. If cultivated for forage, this plant should be sown broadcast in a soil rather dry than moist. It may be sown in the spring or in the end of the summer at about forty pounds to the hectare. Cultivated for the dye, the woad requires a good soil, well prepared and manured, and in this case they sow it in rows, the intervals between which are carefully worked.

Many years' culture and use of the woad, since the above article was written, have proven to me that sheep, cows and oxen will eat it most readily when it is green. I am not prepared to speak of its nutritious qualities, having used it only concurrently with other kinds of food. I have fully satisfied myself that it grows with great facility on indifferent and dry lands, and even on those that are very chalky. This quality, together with its precocity, has induced me to think it a very valuable plant, and one from which much advantage is to be derived.

Pimprenelle, Burnet, Poterium sanguisorba.—The great merit of this plant is that it furnishes excellent pastures on poor and arid lands, whether they are sandy or chalky. It resists extremes both of cold and drought, and affords particularly a valuable resource for the support of sheep during the winter. In some parts of Champagne they have, by the culture of the burnet, produced a sensible amelioration in the state of their agriculture, an amelioration of which thousands of acres in France would be susceptible. On the good lands it is relatively less advantageous, although its vegetation there is so luxuriant as to permit the sickle. By the testimony of many practical men its hay is not good, either for cows or horses, but solely for sheep. Yet I think that on all farms where they keep a flock of sheep during the winter it would be well if good land can be spared for the purpose to have one or more pieces of burnet for their winter grazing. It can be very useful in furnishing, in the summer, green food to use in the stable; it throws out fresh shoots at this season, perhaps more quickly than any other plant, and the green forage suits all animals. The usual time for sowing the burnet is the spring, but the month of September will answer as well on light lands. Sixty pounds of seed to the hectare are requisite.

Spergule, Corn spurry, Spurgula arvensis, is an annual forage, particularly suited to fresh sands, and furnishes an excellent food for cows. In a part of the Low Countries, where the spurry is very much grown, the butter of the cows which are nourished upon it is esteemed of a superior quality, and is called *beurre de spergule.* They sow it generally in the summer, on the stubble fields, after breaking them up by a light working immediately after harvest. They either graze it, or feed it green in the stable, a resource which lasts until frost. Sometimes they mow it, and then it must be sown early; but it loses a great deal in

curing; a defect owing to the aqueous nature of the plant. I find the spurry spoken of in many works as good for fowls, but I have frequently seen them refuse to eat the grain. This grain is very minute, and should be but little gathered. They sow about twelve pounds per acre. The spurry, turned in green, is spoken of by many theoretical farmers (*agronomes*) as one of the best of the ameliorating plants.

WHITE SLAVERY IN GREAT BRITAIN. EMPLOYMENT OF FEMALES IN THE ENGLISH MINES.

From the Plough Boy.

It appears that the employment of females in the coal mines is chiefly confined to Yorkshire, Lancaster, Cheshire and the east of Scotland and South Wales; and the revolting cruelties practised on boys, as detailed in our first notice, is equally extended to girls. In fact, not only are girls preferred as "hurriers," for their greater docility, but they are taken in the mines at even an earlier age than boys, from a supposition that when infants they are the most "cute" of the two. It is distressing to read the accounts which some of the tender females themselves give of the hardships they undergo. One says, "I work in Hardhill mine. We hurry the carts by pushing behind, but I frequently draw with ropes and chains as the horses do. It is dirty, slavish work, and the water quite covers our ankles. I knock my head against the rocks, as they are not so high as I am, and they cause me to stoop, and makes my back ache." Another gives the following dreadful description of what they have to undergo. "My employment is carrying coal. Am frequently worked from four in the morning till six at night, and every other week I work night work. I then go down at two in the day and come up at four or six in the morning. Two years ago the pit closed in upon thirteen of us, and we were without food and light two days; nearly one day we were up to our chins in water." Our space will not permit us to multiply such extracts; and we must therefore content ourselves with stating generally that there is no variation in any part of the voluminous evidence collected on this subject of young girls being employed in coal mines, except that their labor is more severe, and treatment more cruel, if possible, in the east of Scotland than elsewhere.

Nor are young, or even married women, much better off than the girls. Anne Harris, aged 15, "heartily hated it. It was no woman's work, nor is it good for any body; but I am obliged to the work, as father howks (hews) the coals below." Janet Duncan, aged 17, "was a coal bearer at Henmuir pit. The carts she pushed contained 3 cwt. of coals, and it was very severe work, especially when they had to stay before the carts to prevent their coming down too fast; they frequently run too quick and knock us down. Is able to say that the hardest day-light work is infinitely superior to the best of coal work." Margaret Drysdale, aged 15, "did not like the work, but her mother was dead, and her father took her down, and she had no choice. Her employment is to draw carts, and she had harness or drag ropes on, like the horses." One more. Katharine Logan, aged 16, "began to work at coal carrying more than 5 years since; works in harness now; draws backward with her face to the tubes; the ropes and chains go under her pit clothes, (which consist simply of a pair of boy's trousers;) it is o'er sair work, especially when we had to crawl." We can imagine no sight more horrible than young girls harnessed to carts, and drawing them on all-fours through confined passages, perhaps not two feet high, and frequently a foot of that space a thick sludge of water and coal dust; nor can any one form an adequate idea of it without inspecting the plates which represent it in the parliamentary report.

Well may the report say, that "when the nature of this horrible labor is taken into consideration—its extreme severity—its regular duration of from 12 to 14 hours daily—the damp, heated, and unwholesome atmosphere of a coal mine, and the tender age and sex of the workers—a picture is presented of deadly physical oppression and systematic slavery, of which I conscientiously believe no one unacquainted with such facts would credit the existence in the British dominions."

Married woman are chiefly employed in filling, riddling, and carrying, and the labor imposed upon them is excessive. The reason given by one witness (herself married) why they undertake such work at all is, "that if the women did not work below, the children would not go down so soon." The same witness says that she wrought till a stone 14 months ago so crushed her leg and foot that she could not gang; and that the oppression of coal bearing is such as to injure them in after life, few existing whose legs are not injured, or else their haunches, before they are 30. What other troubles married women undergo from an occupation so unnatural for them, will be seen from the following brief abstracts:

Jane Johnson, aged 29—"I could carry two hundred weight when 15 years of age, but now feel the weakness upon me from the strains. I have been married nearly 10 years and have had four children, and have usually wrought till within a day of the child's birth. Many women lose their strength early from overwork, and get injured in their backs and legs."

Jane Peacock, aged 40—"I have wrought in the bowels of the earth 33 years. Have been married 23 years, and had nine children, two still born, and they were so from oppressive work. A vast number of women have dead children and false births, which are worse, as they are not able to work after the latter. It is only horse work, and ruins the women, it crushes their haunches, bends their ancles, and makes them old women at 40."

Isabel Wilson, aged 38—"When on St. John's work I was a carrier of coals, which caused me to miscarry five times, from the strains, and I was very ill after each."

Elizabeth M'Neil—"I knew a woman who came up, and the child was born in the field next the coal hill. Women frequently miscarry below, and suffer after."

Jane Wood—"The severe work causes women much trouble. They frequently have premature births. My neighbor Jenny M'Donald has lain ill for six months, and William King's wife lately died from miscarriage, and a vast number of women suffer from similar causes.

Indeed, all the married women, and there were many examined, relate their experience to the same purport, and it may be asked without exaggeration, whether such a system can be regarded as any thing less than murderous. It is not for us in this place to assign where the blame lies, but we cannot forbear inserting a significant passage from the evidence of another, Margaret Bexlet. "The work," she says, "is not fit for women, and the men could prevent it if they labored more regular. Indeed, men about this place don't wish their wives to work in the mines, but the masters seem to encourage it—at any rate, the masters never interfere to prevent it."

But revolting as all this is, there is something still more so behind. The demoralization of the females, old and young, is greater even than their oppression. We should hardly venture to describe its extent except in the words of the commissioners themselves, and that as briefly as possible.

"In the southern parts of the west riding of Yorkshire," says the report, "as far as relates to the underground employment, there is no distinction of sex, but the labor is distributed indifferently among both sexes, except that it is comparatively rare for the women to hew or get the coals, although there are numerous instances in which the women regularly perform even this work. In great numbers of the coal pits in this district the men work in a state of perfect nakedness, and are in this state assisted in their labor by females of all ages, from girls of six years old to women of twenty-one, these females being themselves quite naked down to the waist."

The extreme indecency remarked in this passage we should infer (from Appendix, part 1, page 181) to be confined to the Flockton and Thornhill pits; but in all of them it prevails to a degree very slightly mitigated in shamelessness. In none do the men wear any other dress than a flannel jacket, or the females add to the breeches, which they wear as a protection against the galling chain which passes from a girdle round the waist between their legs to the load they are drawing, more than a loose ragged shift; and these two very slender improvements are rarely remarked together in the same district. In fact, "the girls are not a bit ashamed among their own pit set," and in the neighborhood of Halifax the practice seems to reach a climax positively disgusting. Mary Barrett, aged 14, told the sub-commissioners that "she always worked without shoes, stockings or trousers, wearing nothing but a shift. She had to go up the headings with the men; they are all naked there; she had got well used to it, and did not care much about it now, but at first was afraid, and did not like it."

We are sorry that the magnitude of the evil compels us, even so briefly, to enter into such details of it, nor must we suppose that the women merely discard all modesty on entering the mouth of the pit. Though the words we have quoted would seem to refer to their conduct under ground, abundance of evidence is scattered through the report that they have not much more delicacy in their recreations and occupations above ground than in their labors below.—The men meet to fight and wrestle in complete nudity, except their clogs; and though the women affect finery when they are "holidaying," they are not at all shy of such exhibitions, nor at any time sensitive about appearing half naked themselves.

"All classes of witnesses," says the report, "bear the strongest testimony to the immoral effects of the practice of females working in mines," "I wish the government," says one witness, (a collier,) "would expel all girls and females from mines. I can give proof that they are immoral; and I am certain that the girls are worse in point of morals than the men, and use more indecent language." "It is impossible," says another, "for girls to remain modest who are in pits, regularly mixing with such company and hearing such language as they do. I have worked myself in pits for above ten years, where girls were constantly employed, and can safely say that it is an abominable system." "Where girls are employed," is the testimony of Mr. Ellison, of Berkinshaw, "the immoralities practised are most scandalous," and Mr. Sadler, surgeon of Barnsley; whose profession enables him to know intimately the habits of the miners around him, confirms it in these striking words—"I strongly disapprove of females being in pits; the female character is totally destroyed by it; their habits and feelings are altogether different; they can neither discharge the duties of wives or mothers. It is a brutalizing practice."

Thomas Wilson, esq., of the Banks Silkstone, and owner of three collieries, though satisfied that "the employment of females of any age in mines is most objectionable," is nevertheless of opinion that it would be impossible for any individual to put an end to it. "I should rejoice to see it put an end to, but in the present feeling of the colliers, no individual would succeed in stopping it in a neighborhood where it prevails, because the men would immediately go to those pits where their daughters are employed." Of the correctness of this opinion, however, there may be some doubt. The mischief seems to have arisen from the practice of the masters (for some reason or other,) allowing the men to find their own drawers and hurriers. "Mr. Hilton, of Wigan," says Mr. sub-commissioner Kennedy, "told me that he should be glad to discontinue the employment of females in his mines; but that it was a custom for the men to find their own drawers, and that the masters did not interfere." Why they do not interfere is not shown. They have interfered in other districts, and with the most happy results; for we find that from all the mines in the vast coal fields of Cumberland, Durham and Northumberland, there is now an "absolute exclusion of all female workers, except in one old colliery belonging to the Earl of Lonsdale."

We may conclude this branch of the subject in the words of sub-commissioner Symonds, that "under no conceivable circumstance is any one sort of employment in collieries proper for females; and that the practice is flagrantly disgraceful to a Christian as well as a civilized country."

RISKS OF MERCANTILE LIFE.

General Dearborn, in a lecture delivered last winter before the farmers of the Massachusetts legislature, declared that 97 out of every 100 persons who obtained their livelihood by buying and

selling, *failed* or died insolvent. This fact he ascertained by reference to the books of the custom-house, the banks, the probate office, and from the recollections of the oldest merchants. If this statement approximates to the truth in relation to the risks of mercantile life, it should induce fathers to instil into the minds of their sons a love of agricultural pursuits. Gen. Dearborn declared that he would prefer a cottage in the country with five acres of ground, to the most splendid palace that could be erected in the city, if he must depend upon the success of merchandise to support it."—*Ohio State Journal.*

A DANGEROUS PROPERTY OF WOOD ASHES EXPOSED, AND SOME OF THEIR OTHER PROPERTIES EXAMINED.

By Dr. John T. Plumer, of Richmond, Indiana.

From Silliman's Journal of Science and Arts.

I have recently devoted some time to a further examination into the properties of wood ashes, and especially into that property by which heat is conveyed from a small space on their surface deeply into the interior of the largest masses. I consider the subject of sufficient importance to claim the attention of the general as well as the scientific reader; for I cannot forbear thinking, that at least some of the mysterious conflagrations which are repeatedly occurring are chargeable to this hitherto unsuspected cause.

Judging by the remarks of Prof. Hubbard, accompanying two cases of combustion in wood ashes, reported by him in a late number of this journal,* it appears to be his opinion that the caloric in question was generated within and near the bottom of the heap, by a spontaneous but unknown process. I conceive that the following experiments render this opinion highly improbable, and they go to sustain the view taken by the present writer, so far as it respects the origin of the caloric, and perhaps measurably as it regards the means by which the heat is diffused throughout the ashes. They show that the heat-retaining power is not peculiar to ashes, but is common to various pulverulent substances; that this residue of combustion contains an appreciable quantity of charcoal in a state of minute division; and, as formerly stated, that it is unsafe to deposite hot ashes upon, perhaps, the largest heaps of cold ashes. I shall marshall these experiments under the head of

Ignitibility of wood ashes.—1. A pint of sifted ashes was made into a conical heap four inches high, upon a folded newspaper, and a coal lighted at one corner only, was laid upon the summit and very slightly covered. In seventeen minutes the coal was examined and found to be wholly ignited. It was again covered, and in eleven minutes afterward, that part of the paper on which the ashes rested became quite warm, and also the board beneath it. On sliding the paper nearly off the board, and gently bending it convexly upwards, I succeeded in producing a fissure, extending from the apex of the cone downward to a considerable depth. By this means I was enabled to see the interior of my diminutive volcano, and to discover that the ashes within were *red hot*, if not incandescent, as far down as the fissure extended. After this peep, I closed up the crater by sliding the paper back upon the board, and waited an hour from the beginning of the experiment. At the expiration of this period, the coal was not wholly consumed, and the ashes were still quite warm.

The coal used in the foregoing instance was of sugar-tree wood, and at the time it was placed upon the ashes, two other coals, one of sugar-tree and the other of beech, were thoroughly ignited and laid upon a board. In two minutes the "fire went out" of both these coals.

2. A wooden pill-box of the largest size was filled with sifted ashes, and an oak coal weighing seven grains was barely buried in them. In thirty five minutes the box was very warm all over; and at this time I surrounded it with cold ashes. In twenty minutes more, the ashes within and immediately around the box were uncomfortably hot.

3. I renewed the second experiment, with the exception of not wholly covering the box. The edge was left exposed, to ascertain whether it would not act as a vent to the accumulating caloric. In half an hour I examined the coal, and found it extinct and the ashes cold. The coal in this case was of beech.

4. This beech coal lighted at one corner, was placed on a cone of sifted ashes, as in the first experiment, and in twenty minutes it was thoroughly ignited. I now pressed a cylinder of pasteboard perpendicularly into the ashes, so as to include the coal and most of the heated ashes. The upper edge of the cylinder was left uncovered. I did not examine the coal for an hour; it was at that time not consumed but dead, and the ashes were entirely cold.

5. I built a cone of a quart of pale ashes and deposited eight or ten dead coals some distance apart, near the base and remote from the surface; at the apex I buried a live coal as before. In three quarters of an hour, stiff paper or a splinter of wood thrust into the centre of the heap took fire; and on demolishing the pile, I found that the heat had descended to the coals below, and ignited them; indeed they were partially consumed, and the whole interior of the base of the cone was extremely hot.

6. A wooden box, ten inches deep and eleven inches square, was filled with unsifted ashes as cold as an exposure of several weeks in winter could make them. A pint of hot ashes was thrown upon the middle of the surface and left uncovered. In eight hours all the central portion of the ashes was hot enough to fire wood thrust into it, and two sides of the box were incalescent. In twenty three hours, the bottom of the box was quite warm, the top of the ashes cool, and the sides of the box were becoming cool. A stick plunged to the bottom of the ashes, was drawn out ignited or burnt at the end, but not even charred above it. In thirty hours the bottom of the box was almost unsupportably hot; and the upper half of the ashes retained but little heat. In thirty six hours, the temperature of the ashes being much reduced, I emptied the box, and found the bottom of it on the inside near the middle converted to coal, one of the sides considerably

* Vol. xlii., p. 165, *et seq.*

charred, and another browned by the heat. Coals were found in different parts of the ashes, but I believe they were confined to those portions through which the heat did not travel.

The ashes used in the foregoing and the subsequent experiments, were derived from the mixed combustion of hickory, beech, sugar-tree, oak, and a few other kinds of wood; and the sieve employed consisted of twenty-four by thirty-two interstices to the square inch.

To what cause could I attribute the augmentation of heat and its downward course, which the preceding instances exhibit? The plausible answer was, carbon. There, said the spirit of conjecture, was the fire, burning its way into the ashes, and leaving successive portions of them to cool after it had consumed the combustible matter out of them; travelling downward, like the Goth's descent upon Rome, into regions where its fierceness could be led. There, too, was the *gray* color of the ashes, produced, said conjecture, by the admixture of fine carbonaceous particles with the pure white cineritious matter. To prove that the proper color of wood ashes is white, there lay the beautiful specimen with gossamer lightness upon the hearth, the residue of the undisturbed combustion of a solitary ember; showing the delicate fibrous structure of the original wood; with open avenues on every side, and a thousand apertures within for the free admission of atmospheric oxygen to every atom of carbon; the carbon thus affianced to oxygen had escaped into the air, leaving its white mansion unshaded by its presence. And how could I better account for the various shades of gray which ashes present, than by supposing them to arise from the various proportions of the black powder intermixed? And then, there were the uniform results of repeated trials by fire, in which something escaped out of the contents of the crucible; and what could this be but carbon? Such was the language of imagination before experiment had fully uttered its voice. To strengthen these conclusions, I applied myself to other evidences; but these, to my disappointment, instead of supporting, kicked against my imaginings.

7. Selecting magnesia as an article possessing physical properties somewhat similar to those of ashes, I erected a cone of this material, and at the summit buried a partially ignited coal. In a few minutes I was surprised to find the whole coal was alive with fire. Shortly afterwards the magnesia beneath the coal became ignited, and the bottom of the heap almost intolerably hot.

8. Guided by the specific gravity and the compressibility of the substances employed, I repeated the experiment with pulverized chalk instead of magnesia. The chalk soon became red hot, beneath the coal; and the base of the heap heated beyond endurance.

Thus discovering that these alkaline earths possessed the same heat-preserving properties as ashes, and that the same downward, centralizing tendency of caloric was shown in all, I was led to the conclusion that the heat eliminated and diffused in the sifted ashes was the result of the combustion of the single coal buried in them; and considering their low conducting and radiating power, it appeared probable that the amount of heat apparent was not very far from the absolute quantity generated during the combustion. In every instance, while the central parts of the cones were red hot, the exterior of the ashes, except at the apex, was cold throughout the experiment. The caloric is evolved faster than it is diffused, and of course it accumulates within a small sphere near the coal to an igniting temperature; combustible matter lying at the circumference of this sphere would ignite and generate another ball of fire, and this produce another, and so on indefinitely, or while the last ignited spheres reached new combustible matter. In this manner I conceive the caloric travelled in the fifth and sixth experiments, and I see no reason why it should not under similar circumstances circulate through a bed of ashes spread over the whole earth.

Satisfying myself in this manner that the presence of pulverulent charcoal was not essential to the phenomenon in question, I submitted other powders to similar trials.

9. Fine sand, scorified wood ashes, anhydrous sulphate of lime, common earth, all thoroughly dried, and the earth and sulphate reduced to subtle powders, were severally made the tenements of a fully ignited coal; but in spite of all the persuasion I could command, the coal refused to be buried alive in such sepulchres as these; almost as soon as it was decently interred, it expired.

PRACTICE OF ENGLISH FARMERS IN THE IMPROVEMENT OF PEATY GROUND.

By Ph. Pusey, M. P., President of the Royal Agricultural Society of England.

From the Journal of the Royal Agricultural Society of England.

Although the improvement of peat is not a subject that can be of general interest, yet, as there are large tracts of such land in the country, and as I have had the advantage of observing in my own neighborhood the mode in which it has been improved by good farmers, as well as of receiving information from members of our society who have reclaimed peat in other districts, I think it may be of some use if I endeavor to describe their various methods of management. Our science, we may hope, would gradually advance, if we could obtain faithful accounts of our actual practice upon each variety of our soil. The peat I am most conversant with, follows generally the borders of all the rivulets in this level stone-brash country. Along the margin of each sand arable farm, there runs a belt of such poor marshy ground. Long after the meadows are green in spring, these pastures retain the brown of winter: in summer they are covered with rushes and coarse grass, but are of some use for the sheep in dry weather: in autumn they soon return to their withered hue; and in winter again they are scarcely to be passed on horseback. Almost every kind of tree has been planted upon them in vain; but the birch, the alder, and the abele, not the least ornamental of our trees, I have found to grow with some vigor: they are too poor for the willow.

The first step of improvement is of course to acquire command of the water and obtain an outfall by digging a straight ditch, about 8 feet wide and 5 deep, down the middle of the hollow: this takes the place of the winding stagnant rivulet that is frequently found there. In wider bogs more of

these ditches should be dug, and one may be placed on each side so as to divide the peat from the sound land, and thus cut off the springs which ooze from the higher ground. However slight the apparent fall of the ground, it is generally practicable, by carrying along the new water-course to a sufficient length, to reduce the level of the water 3 or 4 feet permanently below the surface: this then is the first and indispensable step, the open drainage: the next is the under or close drainage: it has been done on the Deanston principle—thorough draining. The parallel drains have been cut to a depth of 30 inches in the gravel underlying the peat, the materials being tiles and broken stones over the tiles, covered with a sod 16 inches below the surface; the distance between the parallel drains varying from 20 to about 80 feet. The levels are so flat that tiles have been often necessary. It is essential that these drains should be formed before the surface is broken up, that the work may be clean for the laborers: winter and early spring will be the most convenient seasons. In Lincolnshire, however, the heavy expense of under-draining has not been required. Deep open ditches, dividing the peat into fields of 12 or 15 acres, have been found to lay it sufficiently dry.

When the draining, of whatever kind, is completed, the question next arises how the coarse and rushy swamp is to be brought into cultivation. I must say that the practice of paring and burning the surface, employed by our farmers, has been justified by its effects. As soon as the harsh easterly winds of spring have set in, the breast-ploughs are put to work, the surface is pared and turned over, and, when dry, piled in heaps and burnt to ashes. The proceeding may be defended I think on these grounds:—If the coarse sward filled with the roots of rushes were merely ploughed over, it would not decay during the whole summer, and would be far too tough and hollow for any crop that might be sown on it. Again, when a fertile well-dressed surface is burnt, the volatile parts of manure which it contains may be dissipated by fire, but on the land we are dealing with, there is no fertility to be destroyed. Lastly, the ashes which are produced are a manure peculiarly adapted for the crop which experience has taught the Lincolnshire farmers to make their first crop on such land; that crop is rape, a plant not generally grown in this country. On such ground so prepared, it shoots up with unfailing luxuriance, resembling the tops of strongly growing Swedes, but forming a dense mass of dark leaves, about a yard high, through which it is difficult to make one's way. Although peat may be well suited to the growth of rape, it is to the peat-ashes, I believe, that the chief strength of its vegetation is due. In fields where the soil is moory but not a pure peat, when they have been pared and burnt in the same manner, a singular appearance presents itself which proves this point. On the spots where the heaps have been burnt, may be seen dark tufts of rape growing in the vigorous manner already described. On the rest of the ground you can hardly distinguish the pale blue or purple dwindled plants of rape scarcely raising themselves from the surface and choked with grass. This fact illustrates in some degree the chemical laws of the food of plants; for Dr. Liebig states that peat ashes contain a small proportion of potash: I believe that the rape itself also contains potash: hence probably the wonderful influence of peat-ashes upon its growth. There is also a further circumstance which may be remarked; the quantity of ashes which thus occasions the difference between a strong plant 3 feet high and a feeble weed of a few inches, is very small; but, of that small quantity, the potash and other salts which enter into the composition of the plant, and enable it to bring forth its tall stem and broad leaves, are still more minute: the ashes cannot then be called the food of the plant; they can only aid the plant to make use of the other matters of which its vegetable frame is formed; yet they act precisely as farm dung, which is supposed to afford the substance of vegetation. Such is the fact; the explanation remains for that chemist who at some future day shall unfold to us the great mystery of the food of plants.

I have omitted to mention the manner in which the rape or Swedes are sown; and, in now adverting to it, I have to state an instance in which the knowledge of a practical farmer was better than my own theory. I had been very desirous that one of my tenants should subsoil-plough his peat land after it had been drained, in order to let down the water through the tenacious subsoil; this he was very reluctant to do, because in his opinion it could not be ploughed too shallow. He was unwilling even to plough it 4 inches deep, thinking the depth of 2 inches enough. Now it happened that in a peaty field of my own, which had just been broken up, one half of the 25 acres was ploughed 2 inches deep, the other half, contrary to my intentions, 4 inches deep. On the half which had been ploughed shallow, I found a very fine growth of Swedes; on the other, which had been ploughed deep, about 8 acres were almost perfectly bare, nearly every plant having been destroyed by the wire-worm. The looseness of the ground arising from the deeper stirring, may have rendered the progress of the wire worm more easy; but I think the true cause of the destruction was the enfeebled state of the plant, in consequence of which it perished under the attack which greater vigor would have enabled it to survive. This I believe is often the case, and certainly under the strong Swedes on the firmer land, an equal number of wire-worms was to be found. The farmers in fact here, led by experience, carry to a great length the principle of keeping such poor light ground as tight as possible. I should have mentioned that the rape is planted by sowing it broadcast on the unmoved ground after the ashes of the first breast ploughing have been spread, the seed being afterwards covered by paring and turning over another thin slice of the surface in a second breast-ploughing. On one farm, 50 acres of land, which though not peat are peaty and equally loose in texture, were broken up from grass three years ago, and have been cultivated ever since by the breast-plough alone. I did try the subsoil plough last year on two acres of peat, cutting through a subsoil of weak clay, and it appears to me that the present crop of Swedes has suffered materially by the consequent looseness of the ground, the land being but half covered with plants: indeed, although it has been thorough drained, it has returned to the state of bog, and is once more almost impassable. It is right, however, to mention that in Lincolnshire deeper ploughing is practised. Mr. Handley writes to me, "the peat is ploughed as deep or deeper than other lands. A relative of

mine has for years been in the practice, when the surface has become exhausted by cropping, of ploughing with two ploughs in the same furrow, depositing the top soil in the bottom of the furrow, and raising the subsoil from the depth of fourteen inches to the top, with most beneficial results; but if that depth was exceeded, the following crops were bad." But even there the practice is not unanimously approved, and Lincolnshire farms have been by no means exempt from the wire-worm. On Exmoor, too, in Somersetshire, I have lately seen subsoil ploughing practised upon peat by Mr. Knight with success; but there the peat, about 8 inches thick, rests on one or two inches only of retentive earth, to which its growth is owing. Below this crust a porous stone-brash is found. The wetness of the climate may also remedy the hollowness of soil produced by the subsoil plough. The shallow ploughing of our farmers seems to me to be decidedly right upon our own peaty and other loose soils.

I may mention another mode in which this principle has been applied with success for some years by Mr. Williams, at Buckland, on a light blowing sand, as it is called, as it seems to answer equally well upon peaty ground. In the common Northumberland system of growing turnips, it is well known that the ground, when sufficiently ploughed, is thrown up into alternate ridge and furrow with the double-breasted plough, that the dung is placed in the furrows, the ridges split, so what was furrow before, now becomes ridge, and the turnips drilled upon this new ridge standing, of course, over the hollow earth which has been filled into the furrow. But upon a very light sand, Mr. Williams thinking it desirable to keep the ground firm under the root, whether turnip or mangel wurzel, proceeds in this way. The ground is ploughed first very shallow—upon peat it may be merely scarified; the dung is then spread upon the land, the double-breasted plough is used, as in the common mode, to throw up ridges; but the process is now complete, and the turnips are drilled at once on these first-formed ridges, so that, while the dung is collected round them as in regular ridging, they have a solid bed to stand on in this bastard ridging, as it may be called; and I must say that a trial I have this year made of this method with Swedes upon peat, has confirmed Mr. Williams' experience upon sand. This operation, however, which I have mentioned in order to show the leading principle acted on here by farmers in the cultivation of peat—tightness of ground—applies to a later crop of Swedes: at least in the first crop no dung could be required, the ashes being amply sufficient.

Rape or Swedes being established as the first crop, after the breaking up of peaty land, in the system I am describing, the next crop is usually oats: they are drilled in upon a very shallow furrow, with plenty of seed, and well pressed with a press-roll, as well before they are come up as afterwards, in order to guard against the wire-worm, the enemy to be feared on such land. It is remarkable that by very late sowing, as late as the end of April or beginning of May, you may be almost certain to escape the wire-worm—it is supposed, because the oat grows more rapidly out of their reach; but on the other hand it will be harvested late; and there is this further disadvantage, that the grain, which is always light on such land, will become so much lighter, that you perhaps lose in weight as much as you gain in quantity. I may observe that the oats do not ripen together upon this ground: the farmers cut them while they are partially green, because they find that, if they wait until the whole crop has changed its color, the best grains, which are those that first ripen, shed in the mowing and carrying, whereas, these are preserved by early cutting, while the ripe grains and green stalks improve the straw as fodder for cattle. This first crop of oats is generally beaten down by the weather, being weak and long in the straw, and, though not a bad crop, looks better than it really is.

On land which is not peat but peaty, some farmers grow barley: there is a large crop of straw, and it is therefore liable to be laid; the grain, too, is but thin. The advocates of barley, however, assert that a bad sample of barley is better than a bad one of oats, because thin barley may be ground or may be used for seed, whereas seed oats should be as plump as can be found. On the other hand, it has been stated to me by a gentleman residing in Lincolnshire, that "he considers barley the most objectionable grain which can be sown upon peat soil, and that its injurious effects are visible for five years."

The rape and the oats will generally have proved successful, and indeed by their luxuriance may lead one to suppose that more improvement has been made than is really the case. It is now that doubt and difficulty begin. The oats or barley are followed by rye grass, which has been sown among them, but if these have been laid, as they often are, large patches of the rye-grass will have been destroyed. Even if they have not been laid, the peaty soil will perhaps throw out many of the grass-plants by the roots in the next winter, and still more in the succeeding one, if, as is usual here, the rye-grass be left for two years. The motive for so leaving the ground two years in grass is, that it may regain solidity before it is again ploughed: still this is but a poor rotation which gives only one crop of corn in four years. On the other hand, if the ground were left permanently in grass, there is reason to suppose that in a few years the fine grasses would wear out, the coarse herbage return, and the land be no better for the expenses incurred in drainage. Nay, one farmer thinks he had observed it become worse, because the equatic grasses natural to peat no longer obtained the moisture which they require, and the better grasses do not grow well. In order to meet this evil, the gravel or rubble which has been taken out from the main drains, is spread over the ground in the winter before the oats are sown: and, however sterile and hungry be the material thus used as a manure, there is no doubt that it produces a strong effect, for the rye-grass is much thicker and sweeter where this has been done: this is called firming or weighting the land; it is good as far as it goes, but the staple of the soil is still very weak. When wheat is sown on ground that is at all peaty, it will almost certainly lose plant in large patches, even though the land has been dunged, and the young wheat has been trodden in by women, as is sometimes done in the spring. There is clearly some principle defective in the composition of the soil: that principle is cohesion, and can only be supplied by clay.

The operation of claying peat is one of the me-

thods by which English farmers have for many years been silently changing the face of the country, which now constantly come to our knowledge, but for which they have not hitherto received the credit due to them; its effect is so wonderful that I ought not to withhold a further account of it which I have obtained from Mr. Wingate himself, whose farm at Leake is mentioned by Mr. Morton:

"*Dear sir*—I will endeavor to describe to you what we have done in our east fen since its great improvement by drainage, confining myself to that land which I consider decayed vegetable matter on a clay or silty subsoil at various depths, and which had been under water generally for ages in the winter season, and getting partially dry in the summer. A great deal of wood in the first instance was taken out of it—nay, in fact, is still in many parts where the plough goes a little deep, chiefly oak, I believe, but in some instances maple, poplar, and aspens, all lying in one direction. At the time of the first enclosure, from what I hear, the land was brought into cultivation by paring and burning, sowing with cole (rape,) then afterwards oats and rye, which oats it grew of very bad quality, being very light, and I believe it nearly ruined the first class of occupiers. It had been occupied before I took it by a tenant, and had been all clayed over once at my expense. After getting it into my own hands, the first thing I did (it being very much out of condition) was to fallow it thoroughly, and sow it with cole, and I had some very fair crops. After that I clayad it again: we usually have our clay-dikes 11 yards from the centre of each, taking off the peat and putting on the clay, 3 feet wide by 4 feet deep—a very heavy dressing being nearly 300 cubic yards per acre. After that it was sown with, 1st year, oats; 2d, wheat; 3d, cole with manure; 4th, oats; 5th, wheat; 6th, cole or turnips well manured, and then clayed over a third time the same as before; and most certainly I had very productive crops, that is, as much as 5 qrs. of wheat per acre, and from 8 to 9 qrs. of oats, all of very fair quality. I began again to clay the fourth time, but not with the same favorable results, and have only done some little over again, thinking the lands have got quite sufficient solidity; in fact, some of it is, I consider, almost over-clayed. I do not attribute my getting less produce of late years to the over-cropping of the land, but to the destructive ravages of the wire-worm. Still I do consider, on the whole, I have fared much better than my neighbors, who generally have some portion of their land in seeds either mown or summer-grassed.

Perhaps I ought to add, I have generally consumed 6 or 8 tons of oil-cake, with about 12 acres of meadow-land hay, to assist in converting my straw into manure. The size of that farm is about 100 acres. I ridged some peat land for turnips one season, with but indifferent success; and I always find the corn much better and much less infected with the wire-worm in the clay-dikes, where the land has been turned over perhaps from 3 to 4 feet in depth. We attempt very heavy rolling; tread the wheat land with men or women in the spring; but if we have cold, backward weather, all we can do appears of but little avail against the destructive insect.

I have mentioned your note to a neighbor and much respected friend of mine, one of the best cultivators of the soil I ever saw, and he falls in partly with your views of shallow ploughing. I certainly do not. It is possible in the first instance, if you put on a small portion of clay, by ploughing deep you may loose it; then I would say in reply to that, I would clay the land, and sow the crop without ploughing at all, simply well harrowing or scarifying it, then breaking it up and well mixing it. On some peaty land of wretched quality where I live, I have doubled, nay trebled, the produce by drainage and very heavy claying.

WM. B. WINGATE."

I do not quite agree with Mr. Johnson as to the application of lime in the quantity of 250 or 300 bushels per acre, although he has high authority in the theory of Sir Humphry Davy; not that I so much doubt its efficacy as fear the expense. Indeed, Sir Humphry Davy's opinion, that quick lime will dissolve peat, is now much doubted; lime, too, is generally applied not in a caustic but in a slacked state, and the advantage of burning lime for farming purposes is by many supposed to consist merely in its consequent reduction to a fine powder.

As this is a point, however, on which the farmers of one half of England, the western side, would probably give an opposite opinion to those on the eastern side, while in Lincolnshire a most important improvement has been made with clay only, and lime has been tried without any advantage, it is right that I should now mention two instances of great success effected by means of lime. For the first case, I am indebted to Dr Buckland, on whose application Sir Charles Monteith furnished to him the following account of some extensive operations on peaty land in Scotland:—

Edinburgh, Nov. 7th, 1841.

"*My dear sir*,—It is the general opinion amongst improvers of peaty soils that lime is absolutely necessary to produce a crop of grain well filled with farina; and I found from experience, in the improvement of part of my peat-meadows in view of my house, that when the first crop grown upon it was potatoes well dunged but without lime, the potatoes were found to be hollow in the heart of them and very watery, while in other parts of the meadows upon which dung was employed, potatoes of a good quality were produced when lime was employed in addition to the dung.

"The farmers in Scotland think they cannot raise good crops of grain without lime, as the greatest part of the south of Scotland is composed of new red sandstone, grauwacke, and granite, and therefore devoid of lime, which forms a very considerable portion of every fertile soil; indeed it was found that the soil in Dumfriesshire did not produce well-filled barley crops till the farmers employed lime, which they now do to a great extent, and find it equally useful for potatoes and turnip crops, which is amply testified by the farmers purchasing lime to the amount of 3000*l.* annually from my lime-quarry at Close Farm.

"You are correct in saying that a considerable part of my peat-bog improvements have been made by lime alone, and have been productive of very tolerable crops of hay. I have always considered peat more suitable for crops of grass than corn. In addition to the lime I have commonly employed 50 or 60 tons of sandy earth to the imperial acre of peat-bog.

"I have improved about 200 acres of peat-bogs, the average not worth 6*d.* an acre in their natural state, now worth fully 3*l.* A considerable part of it was very expensive to accomplish, as it was necessary to fill up large holes from which peat had been dug for fuel; many acres of it cost me upwards of 30*l.* the acre; but still this ground remunerates me for the expenditure of so large a sum, besides removing an ugly object in the middle of the low grounds in the neighborhood of my residence; every hollow, of which there were many within a mile of the house, was filled by an ugly, useless, black peat-bog.

"I do not recollect whether I pointed out to you some grass-fields that had been improved from black moor-land, by first paring and burning, and then ploughing the first season, the ground being exposed to a winter's frost, and during the next summer lay about 160 bushels of lime upon the imperial acre, and sowing out the ground in July or August with 5 bushels of the holcus lanatus without taking a corn crop. The reason why I did not take crops of corn from moor-ground generally having a peaty surface of 4 or 5 inches, was to keep it in a compact state; as I have found that soil of this kind, after bearing crops of corn and being frequently ploughed, becomes so loose and pulverized that the feet of cattle completely destroy the pasture, and that the roots of the grass are injured by the loose state of the ground. This grass-land has given me upon the average from 12*s.* to 14*s.* per acre annually, in its original state not worth 1*s.* 6*d.* The moor-ground upon grauwacke after this improvement is much more valuable than where the subsoil is sandstone.

"I have employed lime as it is practised in Derbyshire to great advantage upon the surface of moor-land; but as it requires a very large dose of lime, it can only be done where lime is cheap, as it requires from 200 to 300 bushels of lime per acre to destroy the great quantity of vegetable matter in moor soils, which it soon accomplishes, as is shown by the land being soon filled with moles, which are drawn to it by the decayed vegetable matter producing worms, the food of moles.

"In Craven, in Yorkshire, lime is employed very extensively as a top dressing even upon limestone soil. I have found that the cattle feed upon pasture well top-dressed with lime much quicker, and that the meat is much richer and better mixed, than upon pastures apparently equally productive of herbage. I remain, dear sir, yours truly, C. G. STUART MONTEITH.

"The Rev. Dr. Buckland."

It is certainly a very successful operation to have improved, at whatever expense, 200 acres of land from the value of sixpence per acre to that of three pounds. I have lately seen as great an improvement upon the property of Mr. Blake, at Upton, in West Somersetshire. The peat-bogs there lie on the slope of a hill. The mode of treatment was this:—To underdrain at depths varying from 3 to 6 feet, to pare and burn the surface, to grow turnips two years successively, dressing twice with 50 bushels of lime per acre, then to lay the land down with grass seeds to permanent pasture. The grass is let yearly at sums varying from 3*l.* to 4*l.* per acre. It is singular that in one field so treated, and afterwards watered, no trace of the peat remained in the upper part of the soil, which had become a pale-colored earth—I suppose by the entire destruction of the peaty substance. The grass on this land is sweet and close, like the turf upon chalk downs, and the land almost as firm. This land is on the same subsoil with Sir Charles Monteith's, the grauwacke or shillet, an imperfect clay-slate, which in Somersetshire, as in Scotland, is considered favorable to grass.

It is proved then, by the success of farmers generally in the fens of our eastern counties, of Sir Charles Monteith in Scotland, and of Mr. Blake in West Somerset, that peat, which by nature is the most unpromising of all wastes, can be profitably improved, and even be raised to the rank of our most productive soils. But, in order to effect this great benefit, it is considered necessary that either clay or lime should be applied to the surface—which, however, of the two is not certain. Finding this variety of practice, I have endeavored, in the course of drawing up this statement, to obtain fresh evidence in order to clear up the point. I cannot say that I have succeeded in clearing it up; but the facts which have come to my knowledge may serve as materials for future inquiry, and I ought therefore to lay them shortly before the society. It occurred to me that, as the Lincolnshire farmers, who had been so successful in the use of clay, had derived no benefit from the use of lime, the Lincolnshire clay possibly contained lime already. Mr. Cooke, at my request, sent me two specimens of clay from Digby Fen: one of these, a very strong clay in appearance, effervesced much with muriatic acid, and consisted entirely of finely-powdered lime mixed with fine sand. It contained, I believe, scarcely any true clay; it is, in fact, a strong blue marl. The second specimen contained no lime at all, some true clay, and a great deal of fine sand. Mr. Cooke stated, as I expected, that the first specimen was a much more effective dressing than the second: but I learned on the other hand from Handley that a clay resembling Mr. Cooke's second specimen had been used with great success by a relative of his own; and a clay of Mr Wingate's, which I examined three years since, certainly contained no lime at all. Lime, therefore, is not indispensable for the improvement of *some* peat. Dr. Buckland suggested to me that such peat may contain lime already; and I have since found his conjecture perfectly right in the following instance. On my mentioning to Mr. Wingate that some of the Lincolnshire clay is in fact marl, he replied that he had carted marl upon peat without benefit, but had found clay to answer upon the same peat. I asked him therefore for specimens of the two substances. The marl, which had entirely failed, proved to be a white tenacious marl, consisting entirely of powdered lime, apparently unmixed with any other description of earth. The blue clay, which had succeeded, was in fact a marl also, containing a large quantity of lime mixed with clay and fine sand. The peaty soil when mixed with acid threw up bubbles copiously; so that, as Dr. Buckland had anticipated, it contained enough lime in its natural state. In another part of the fens a white marl lies so near the surface of the peat that it is purposely brought up by the plough, and therefore forms what is locally called gray-land, a soil of known fertility in that district. I am not aware whether this peat contains lime naturally.

But although we must remain for the present uncertain as to the application of lime to peat, there are some rules which those who are desirous of reclaiming their peaty land may gather from the practice of English farmers, to serve for their guidance until further discoveries shall have been made. Peat must in the first place be laid dry by open ditches, and further, where necessary, by under-drains also. It may be pared and burned, and sown with a shallow furrow (for all farmers agree that this first ploughing should be shallow) to rape, Swedes, or turnips—sown early for the reasons already given. It is next necessary that some other earth should be laid on the peat; if the subsoil be clay, that clay should be brought up from wide trenches—if it be gravel or sand, I would bring up a portion of it, however poor it may be: if clay be near at hand, I would cart it upon the peat.

There is, however, some difficulty in carting clay upon peaty ground, for the lumps of clay must be spread on the ground and exposed to alternate frosts and thaws, expanding and contracting them, which gradually break down by the spring. The peat, however, is generally so soft in winter, that it will scarcely bear up a loaded cart, unless during a frost, so that the work is often interrupted. The clods may also be reduced by exposure to alternate drought and moisture in summer; but this is a less convenient time for carting the clay, and it must take place on the rye-grass, which is therefore lost. If spread in winter after rape or Swedes, the clay is harrowed in dry spring weather, and ploughed in with a two inch furrow, or scarified. I would on no account burn the surface again after it has been spread, because it is well known that clay once brought to the state of brick, however finely ground, never recovers its quality of cohesion.

It must be remembered, also, that there is a wide difference among clays; and, where the heavy expense of carting is incurred, it is of course important to choose the most effective clay, in order that a smaller bulk may be sufficient. Clay for this purpose should be, I believe, of the most solid and glutenous kind. However wet the place from whence it is taken, it should feel solid when rolled in the hand; if it be loose and liquid, it probably contains too much fine sand; if gritty, coarse sand.

Generally in draining, but almost always in peat draining, it is necessary to dig deep open ditches as main outfalls for the water. The strand or clay thus thrown out, should not be left in a high ridge, but should be spread by wheelbarrows over the peat land in winter. The steep banks, however, of a ditch five feet deep will crumble in year by year, and, unless the water-course be constantly cleared, there will arise some obstruction. But in Scotland, as Mr. Morton informs me, there is a very neat practice of shelving back the banks from the water's edge by a gradual slope of 15 or 20 feet into the field, so that the new level of the water-course is thus placed for ever beyond the chance of neglect; and if the field be arable, the plough works down to the very brink. The appearance of this Scotch practice is exceedingly neat, and its application to peat land is, I see, very easy.

REPORT TO THE STATE BOARD OF AGRICULTURE,

ON THE AGRICULTURE OF PRINCE GEORGE COUNTY.

At a meeting of the Prince George Agricultural Society, on July the 4th, the following report was submitted by the committee previously appointed, and adopted by the society, and a copy ordered to be sent to the Corresponding Secretary of the State Board of Agriculture.

It is with the most unfeigned gratification, that your committee have seen the legislature of our native state, by the appointment of a State Board of Agriculture, at last *begin* to move in this great and all-important matter. Agriculture is universally admitted to be not only the main-spring of all other interests, but the very basis of all permanent power and prosperity in every community; and yet the fact is notorious, that it has heretofore been utterly neglected by our government. It has not only been denied all direct legislative aid, but has been crippled and shackled by injudicious enactments, and measures of protection extended to other and opposing interests. Your committee trust that this suicidal course is at an end, that a new and brighter era is about to dawn for the cause of agriculture. Of this there is an earnest in the promptness and zeal with which the members of the board undertook the arduous labors of their appointment. Without the prospect of one cent as remuneration, or of even having their necessary expenses defrayed, and actuated alone by a sense of duty to their country, and the noble ambition of benefiting their fellow countrymen, they at once resorted to the capital, some of them from the remotest parts of the state, for the purpose of laying the groundwork of their future operations. For this they deserve and will receive the hearty thanks of every patriot. And can it be doubted that within the limits of our extensive territory, there are many such spirits willing and ready to do good, waiting only for the means of action? Let all such remember, that the means are now at hand. A *beginning* has been made. Let them respond to the efforts of the board, give them all their aid, encourage them in their arduous task, and by the good fruit which the board so supported will assuredly bring forth will our legislature in their turn be encouraged to go on in its support of agriculture. What the Highland Agricultural Society has done for the improvement of Scotland, our board, properly seconded by the societies and farmers of the state, can and will do for that of Virginia. Without further preface your committee will proceed, to the best of their ability, to report on the agriculture of Prince George county, and in doing so they will aim to follow as closely as they can the queries of the Board.

1. *Geographical state.*—Prince George county extends along the southern borders of Appomattox and James rivers, from Petersburg to Cabin Point Creek, a distance of about forty miles. On the south it is bounded by the county of Sussex. Blackwater, having its source in the vicinity of Petersburg, and emptying into the Chowan, runs through the whole extent of the county, dividing it into nearly equal parts. Baily's, Powell's and Ward's creeks, with many minor streams of the

same character, make up into its northern section from James river, and are worthy of notice as contributing with their tributary streamlets, to render the river portion of the county broken and hilly. The dividing ridge between the waters flowing into the James and those flowing into Blackwater is another important feature in the *surface* of the county, and like all the dividing ridges in lower Virginia is nearly level. Its general course is east and west, and its elevation above tide probably one hundred feet. In it or near it, all the small streams take their rise, running northward into James river or southward into Blackwater. This ridge may be not inaptly termed the back bone, and the secondary ridges or spurs, running out on each side nearly at right angles, the ribs of the skeleton of the northern section of the county. Towards James river, these spurs run out at nearly an equal elevation with the main ridge; while the ravines and creeks which separate them rapidly fall to the level of tide, so that this whole section, it will be readily seen, is varied and broken, presenting a picture of strips of level ridge land, with abrupt and steep hill sides, and separated by deep ravines. Such bottoms are generally narrow, and the spurs of the main ridge extend quite to the river bank, so that but little alluvial formation, with one or two remarkable exceptions, such as Jordan's Point and Brandon Neck, is any where found. The level of Blackwater is considerably higher than that of James river, and hence the slopes to it from the ridges on either hand are much more gently undulating. On the south of this stream, which is very sluggish from having but little fall, the face of the country may be described as level.

The few low-grounds to be met with are generally on the smaller streams in the interior. They are very limited in extent and rarely well drained. The marshes on James river lie too low to be successfully reclaimed, and are the fruitful sources of miasma, which causes autumnal diseases. In some localities, particularly favorable, these marshes have been reclaimed and cultivated for a few years, but without an exception they have been again given up to the waste of waters, from the gradual but not the less certain decay of the vegetable matter, of which all such soils are principally composed. None of the extensive swamps on the main stream of Blackwater have ever yet been reclaimed, and until by some act of legislation the stream itself is properly opened, a large amount of otherwise valuable land will for ever be lost to agriculture.

Soil.—Omitting the small alluvial bottoms just referred to, a few cases of fine neutral loam on the river, and the still more rare and restricted spots of calcareous soil, occasionally occurring along the shelf of the river bank, the soil throughout the county is either acid or a free light soil. The former occurs on the ridges, while the latter is found in the slopes, such is the case with the main ridge and all its spurs. The steep sides of these spurs as they approach the river, improve in quality, producing hickory and dogwood. The original growth of the acid land is principally short-leafed pine, (intermixed with oak on the stiffer portions,) and black-jack oak with a copious undergrowth of whortleberry bushes. The soil varies in all degrees from very light to very stiff, much the greater portion of the surface of the county, say three fourths, being light. The acid soil was originally very poor, and must have ever continued so without the application of calcareous matter. In fact such land is not now considered as worth the cost of clearing, unless accessible to marl or lime. Under culture, its product in grain was meager indeed, and after a few years contest with its vigorous crops of sorrel, it was generally turned out to put up in old-field pines. As poor as the soil was constituted by nature, however, the hand of man seems to have been actively employed in reducing it still lower in the scale of poverty. Thousands of acres after having been cleared and tilled year after year, till completely exhausted, have been given up as worthless, or in common parlance "turned out." Even the good lands which nature had located on the streams had shared much the same fate, until heart-sick and despondent, the farmer turned his eyes to the rich soils of the west, and prepared to leave the home of his fathers and the scenes of his own youthful associations. Such was the exhausted condition of the soil, and such the general state of feeling when the general and important discovery was made, that our pine barrens and exhausted hill sides contained within their own bosoms the means of their resuscitation. For one of our own citizens and farmers, we are proud to claim the merit of the discovery of the virtue, and of the practical illustration of the benefits of marl applied to our lands. This brings us to the consideration of the subject of

Minerals.—*Marl* was first applied by Mr. Edmund Ruffin, on the Coggins Point farm, 25 years ago. Guided alone by principles of theory in this new and obscure pursuit, he committed errors, which time and experience alone could have enabled the experimenter to avoid, which tended much to increase the existing doubts of his friends and neighbors. The highly beneficial effects of marl were not long however in developing themselves, and from that time to this it has been steadily winning its way more and more each year to the favor of all interested in the tillage of the earth. A little experience has corrected many early errors, and a greater economy of application, with greater and more certain benefit, may now every where be seen.

In vol. viii No. 8 of the Farmers' Register, we have the concurrent testimony of a number of our best and most practical farmers on this subject. They tell us that the first crop after an application of marl is usually increased from 50 to 100 per cent. that this increased power of production in the land continues to increase annually, and that under a judicious system of farming, this additional fertility will never be lost, and that putrescent manures are both more efficacious and durable than before the marling.

Marl is found very generally throughout the county, of a quality sufficiently rich, and in localities sufficiently convenient to induce its application. Between Bayley's and Powell's creeks on the river, and in all the bottoms and ravines emptying their waters into them, it is especially found in abundance. Also on Blackwater and its tributaries. The marl which is most common, varies from 35 to 60 per cent. of carbonate of lime, generally of a blue or yellow color, and belongs to the formation known amongst geologists as the mio-

cene. On the river, in small quantities, is also found the eocene, varying from 50 to 80 per cent. of carbonate of lime. This marl is very valuable, and to a small extent has been and is still carried by water to some of the neighboring counties. The most usual mode of applying marl pursued is on the field to come into corn, and before the breaking of the land. The rate is dependent on both the strength of the land, and that of the marl, being directly proportional to the former and inversely to the latter. Land also containing much vegetable matter, as new grounds or woodland, will stand a much heavier dressing than old reduced land. On an average, 250 to 350 bushels to the acre may be set down as the usual rate. In marling pine old fields, the trees are merely belted by some of our most judicious farmers, and as much as possible of the vegetable matter allowed to rot on the land, instead of being burned off. It has been found the longer such land can be marled, before being brought under culture, the greater the benefit derived from the application.

Green-sand, or gypseous earth, is another mineral beginning to attract general attention. It is found in great abundance on the river, underlying the marl, and recently it has been discovered in several localities in the interior of the county. It is believed to be the same as the green-sand of New Jersey, except that it belongs to a more recent geological formation. This earth has been frequently described in the Farmers' Register, under the different names of gypseous earth and green-sand. Its value as a manure has yet to be fully tested. It has never been applied except to very limited extent and on very few farms, for the sake of experiment. Some of the applications have been highly beneficial to the clover crop, while others have as signally failed. It is hoped that the several interesting experiments, undertaken this year by members of our society, will shed some light on this subject.

Gypsum (sulphate of lime) is found in considerable quantities in the green-sand deposites, particularly at Evergreen, where large and beautiful crystals are found in abundance.

Water.—There is no lack of good water in almost every section of the county. Cattle no where suffer for want of water.

II. *General management of land.*—Here, as elsewhere in lower Virginia, before the introduction of calcareous manures, the usual amount of crops was kept up by annual clearings of new land. The introduction of a piece of new land was attended with the abandonment of a portion of the old. When brought into cultivation, so long as the soil *appeared* by its scanty returns to repay the farmer for a wretched and stinted culture, so long, year after year, was it made to produce its lessening crops. When all semblance of remuneration even had disappeared, it was then *turned out* to grow up in pines, and more virgin land substituted in its stead, to undergo in its turn the same scourging process, and to be itself impoverished without enriching its owner. Marl, the great renovater, has however produced a marked revolution. These abandoned old fields are now considered valuable land, and when marled become under good management permanently productive. Where marl is introduced, we hear no more of turning out land or of emigration to the west.

At one time tobacco was our principal market crop. After its culture was abandoned, grain next became the object of attention. The most usual system of rotation then adopted by those considered the best farmers, was one of three years—1st, corn, 2d, wheat or oats, and 3d, pasture. In too many cases, a grain crop (alternately corn and wheat, or oats) was taken every year. The scourging effects of both plans were as plainly evident as the former exhausting culture of tobacco. After 'Arator' appeared, many of his followers added a fourth year to their rotation, taking only two grain crops in the four years. With the appearance of 'Arator' may be dated the dawn of agricultural improvement in our section of the state. He had many and enthusiastic followers who adopted his enclosing and four-field systems; and although by too strict an observance of his principles, under circumstances in which they were by no means applicable, oftentimes serious injury was sustained, yet tide-water Virginia owes John Taylor of Caroline a lasting debt of gratitude.

The management on the marled or improved land lying principally in the river section of the county, and on the unmarled lands which lie principally in the outer part of the county, is so different that each section must be taken separately.

1. *On the unmarled lands.* Size of farms varies from 150 to 500 acres. Rotation generally of three years, corn, oats and grazing; in some cases a grain crop every year. The land is light, and too thin for the profitable production of wheat. The farmers find a ready market in Petersburg for their little surplus corn and oats. Their corn culture may be detailed in a few words. The land is broken up late in the spring with one-horse turning ploughs. The corn is planted in latter part of April or first of May, in checks of four feet each way, and when considered safe, thinned to one plant to each hill. The cultivation consists of ploughing three or four times with trowel hoes, alternately lengthwise and crosswise. Also the hand-hoes pass over the crop two or three times, hilling each time. The fodder is pulled and tops cut. The yield in corn scarcely averages 10 bushels to the acre. In March the oats are sown on the corn land of the previous year, and ploughed under with the one-horse mould-board plough. Sometimes a harrow is passed over the field to level it. The ploughing for each crop is shallow and imperfectly executed. With a few eminent exceptions, the spirit of improvement has not yet been felt. Little or no attention is paid to the collection and application of putrescent manures, and there is no doubt that the lands are annually deteriorating.

2. *Marled lands.*—Here your committee are gratified to be able to present a more pleasing picture. The lands are in a rapid state of improvement, better systems of farming have been introduced, and altogether agriculture is advancing with rapid strides. The farmers too have improved, as well as their lands; a necessary result. They no longer follow blindly in the footsteps of their forefathers, but each man thinks for himself, so that on every farm there is some peculiarity of management, of tillage, or of improvement not elsewhere found. The general management of land, however, is much the same. Many, if not most of these lands were once the meanest in the

county. In improving by marl, one of the main principles acted on is, to combine with the application of marl the non-grazing system. All the vegetable matter grown on the land, when not in crop, is allowed to fall and rot on it. Grazing is most studiously avoided in the beginning of the improvement. Clover is sown as soon as the land will bear it, generally with the first small grain crop after the marling. The culture of clover and application of putrescent manures are the chief means relied on to perfect the improvement begun by the marling. Until marl, the main-spring of all our improvements on originally poor and acid land, is applied, clover will not grow, and manure yields no profit, the main result of its application being an abundant growth of sorrel. Calcareous and vegetable matter are the two great instruments for improving the soil, and which have been furnished without limit, by an all-bountiful Providence.

When the land becomes well filled with vegetable matter, which it will do in a few courses of the rotation, if it is not subjected to the hoof, some farmers think that mild grazing is judicious, particularly on light or puffy soil, as serving by the trampling of the cattle to render them more compact, and also to destroy many insects inimical to the succeeding crop. The plan of not grazing has led in a few neighborhoods to the adoption of a common fence, enclosing several farms. There was one instance of ten or a dozen farms, containing together several thousand acres under one enclosure. So long as they were opposed to grazing, each farmer kept no more stock than absolutely necessary for his comfort and farm operations, and these were looked after by a little boy to prevent trespass on the neighbors. Where fence timber is scarce, labor dear, and grazing not desirable, this system is attended with many advantages. As the lands have improved, a larger supply of stock has become advisable, grazing is thought more desirable, and this system of a common enclosure is gradually abandoned.

Rotation.—The system of rotation on the marled lands most in use is that of three fields; 1st, corn, 2d, wheat, with oats on the most inferior portions, 3d, clover not grazed. A standing pasture in addition is necessary for the cattle in summer, or if without one the cattle are turned into the woods. Under this rotation, an average of 22 to 25 bushels of corn, and 10 to 12 bushels of wheat is made to the acre. There can be no doubt, that to our tide-water section, where the land is generally level, and better adapted to the growth of corn than wheat, and where a choice of markets is presented to the farmer, this rotation is admirably adapted. A rotation of four years with only two grain crops, viz: corn, wheat, clover, clover, (or if land is too thin for clover, weeds instead,) has been adopted with marked benefit, where land was very poor in the beginning. As the land improved, however, it became necessary to abandon it, for in the second year of rest the land became excessively foul. In some few cases, the famous four-field and fallow rotation, of corn, wheat, clover, wheat, has been tried, but has been found too scourging, except on the fine alluvial loams of Brandon Neck, where it is still in use on one or more of the farms. Besides drawing too heavily on the soil, the amount of land in corn annually is thought too small, in what is a better corn than wheat growing soil. On a few farms, either hilly and rolling, or well adapted to wheat culture, a rotation of five years has been introduced, with three grain crops, viz: corn, wheat, clover, wheat, clover. The second field of clover to be grazed. At Evergreen, a portion of the farm, a fine wheat soil, marled, has been kept alternately in wheat and clover for 9 or 10 years. The first crop of clover has been usually mowed, and the whole partially grazed, yet the land has greatly improved. The wheat crop however has diminished, on account of the blue grass and other vegetable pests which have taken possession of the land. The introduction of a hoe crop for the purpose of cleansing it has become necessary. Under the rotations in which fallowing for wheat is done, the average crops of corn are about 25 bushels, of wheat after clover 15 to 20, and of wheat after corn 8 to 10 bushels per acre.

Manures.—Under all these systems of rotation, much attention is paid to the collection and application of manure. All the offal of the corn and wheat crops, and frequently leaves from the woods are used for this purpose. When the farmer has not stock sufficient to trample these materials, they are often applied in a raw state, and always with benefit. On land which has been marled, the application of straw, pine beards or any vegetable matter, however coarse, has uniformly repaid the farmer for his trouble. Straw is very economically hauled on the land in return loads, at the time of hauling in the wheat to the thrashing machine. Spread over the young clover at that season, it will produce a most marked effect the following spring. With regard to the mode and time of applying manures, there is a great diversity of opinion and practice. Most commonly the manure is given to the corn crop, sometimes ploughed under, sometimes applied on the top. A favorite mode of application with some few is in the spring, on the clover or grass land to be fallowed in the fall for wheat or corn. Its advocates contend that this application is not only the most easily made, but also that, in the following crop, they receive the benefit of the manure greatly increased by the additional growth given by it to the clover or other grass. Others again prefer to apply their manure as a top dressing to wheat in the fall or winter. For this purpose they prefer manure well rotted.

Where good and practical farmers differ so widely, your committee feel safe in coming to the conclusion that though some mode of application may be more economical and beneficial than others, yet all the different modes are good. The best farmers use all diligence in the collecting and applying manures. They make it a matter of primary importance, not a mere secondary business which is made to yield to more *pressing jobs*, and put off for a more convenient season. Stock of every kind, horses, cattle, hogs, and sheep are made to increase the manure heap, and are furnished with abundant materials for that purpose. Let no farmer hesitate to carry out his manure, because he may be either too late to give it to the corn or because he may be unable to plough it under immediately. The greatest error committed by our farmers is in failing to carry out their summer-made manure. It is too

often left at the stable doors in heaps to heat and fire-fang, or spread out over the pens and yards to be drenched by every rain or exposed to the rapid evaporation caused by a summer's sun. In either case it will sustain a heavy loss, whereas, if carried out as made, and applied to the clover, it will add 50 to 100 per cent. to its growth, which when turned under together with the manure remaining unappropriated, would produce a degree of benefit far exceeding that accruing from the same bulk of manure after months of waste and exhaustion in the barn yard. Such is the practice on a few farms, and its good effects are very apparent.

Preparation and tillage of crops.—For corn the land is broken in the fall and winter or early spring, with two and frequently three mules to the plough, from 5 to 8 inches deep according to the depth of soil. Shortly before planting, the land is well dragged with heavy harrows, and the rows laid off 5 or 5½ feet apart. The corn is dropped in the row from 10 to 36 inches apart, and at the proper time thinned to one stalk to the hill. Some farmers cover their corn with the harrows and when the land is not very foul this is a cheap and excellent plan. It covers the corn effectually and leaves the land in fine tilth. As soon as the corn is well up, a furrow is backed off from the row on each side, by a one-horse mould-board plough. The hoe-hands follow after, weeding and thinning. The next operation is to reverse the furrow, throwing the earth to the corn with the same plough, and breaking up the entire balk. The cultivators follow to level the land. Such is the usual mode of corn culture, and is usually finished by harvest time, though in wet and backward years it is found necessary to pass the cultivators again over the corn, and also the hoes over the foulest parts, after harvest. Some of our farmers from the hilliness of their lands prefer the use of the trowel hoe and level cultivation. These, to keep their corn fields in order, find it necessary to plough early and often. Capt. H. Cocke, of Evergreen, has introduced the use of the two-horse turning plough in the culture of corn, and when the grass has once the start, it is the most ready way to check its progress. Fodder is usually pulled and tops cut for long forage, and about October 1st, the cutting up of corn is commenced for seeding wheat. In sowing wheat on corn land two different modes are pursued. Most farmers plough the land first with two horse ploughs 4 or 6 inches deep, and harrow in the wheat, while others sow on the hard surface and plough under with one horse ploughs, usually harrowing afterwards to level. The same remark applies to sowing oats in the spring on the portions of the corn land deemed too thin for wheat. The latter practice, it is believed, is rapidly giving way to the former. Those farmers who fallow for wheat, commence that operation as soon after the 1st of August as possible. The ploughing is done effectually 7 or 8 inches deep, and the vegetable matter well covered. They aim to complete the ploughing by the 20th of September. The land is well dragged both before and after the seeding. The first gives a good seed bed, the last covers the grain. Grips or water furrows are opened where deemed necessary for properly draining the field. Bedding land for wheat is not usual, except where the fields lie very level. The mountain purple straw wheat is without an exception preferred. From the 5th to the 25th of October is considered the safest time to sow; though wheat sown as late as the 10th of November sometimes does well.

The wheat crop with us is frequently much damaged by the fly, and sometimes almost destroyed by rust, though it is not more liable to these evils than elsewhere. Corn is a much more certain crop. The chinch bug is a formidable pest to both wheat and corn, as was witnessed in the years, '38 and '39, but is fortunately of but rare occurrence.

The *price* of corn is very variable. The average of late years, is believed to be 55 cents per bushel. That of wheat 110 cents per bushel. Oats are only made for consumption on the farm.

Grasses.—The only grass cultivated to any extent is clover, which is considered an invaluable aid to marl in the improvement of land. The seed is generally sown on land in wheat, in the latter part of February, on all the improved lands, at the rate of one gallon to the acre. Clover is also found to succeed very well after oats, in which case the seed is not sown until March. The following fall twelve months, the clover is turned under for wheat or corn. A bushel of plaster of Paris to the acre, where sown the second spring, has been attended with marked effects. Also a dressing of 40 bushels of greensand to the acre, but success is not uniformly met with in either case. The clover, when good, is frequently cut the second spring for hay, though the chief long forage relied on for stock is the fodder, tops and shucks of the corn crop. Clover hay is frequently much damaged by too much exposure to the sun. As far as practicable it ought to be cured in the shade. The plan adopted by those who have been most successful is to cut the clover when free from dew or rain water, and as soon as it wilts to throw it into cocks about 4 feet in diameter at the base, and 4 or 5 feet high, where it is left until cured. About the third or fourth day it is ready to pack loosely in a hay house or open loft. Cured in this way, the hay is made with little trouble, not much risk, and retains both its leaves and blossom, and the green color of its stems, and is eagerly devoured by stock of every description.

Several efforts have been made to grow herds-grass, but have not been attended with full success. The cause of failure is believed to be the fact that the land in the first place is not sufficiently cleansed. To lay down a meadow in herds-grass, it should first be cultivated in corn or some hoe crop two years or more, until thoroughly purged of all weeds, briers, and other pests. If then well drained, and sown at the rate of one bushel of seed to the acre, there can be no doubt of success.

In many places excellent natural grasses occur, which are converted into very good hay.

Draining is too much neglected by even the best of our farmers. Small strips of low grounds on almost every stream are seen, which might be the source of a handsome yearly revenue if properly drained and set in grass, but which now remain neglected, to breed disease and mosquitoes. Even some of our high lands are still suffering from surplus water. This evil is now beginning to be attended to, and will in a few years be re-

medied. Our farmers have heretofore been entirely engrossed with the very important matter of rendering their soils calcareous. As this great task is completed, more time and attention is devoted to other branches of agricultural improvement. The great benefit of draining is illustrated at Cawson's, the farm of Mr. John Meade, where the product has been increased from three to seven barrels of corn per acre, by no other process than that of freeing the land of all excess of water.

Live stock.—Our county is emphatically grain-growing. A few surplus lambs and veals are sold, and old oxen are converted into beeves, but no animals are raised expressly for market. Not enough hogs are raised to supply the home consumption, and we are mainly dependent on the west for our supply of mules and horses. This is a matter which ought to be corrected, and which, it is believed, is in the course of correction. Much more pork is now raised in the county than even five years ago. The neat stock are of the indifferent, though hardy native breed. Some attention of late has been paid to the improvement of both cattle and hogs, by the introduction of animals of a superior breed.

For many years we have been exempt from any general and disastrous diseases amongst the stock.

Dairy management.—No revenue of moment is drawn from this source. Every farmer makes enough butter for his own use, and some few make it to sell. This, like many other matters, has heretofore been neglected, because, in undertaking the improvements which are even yet in their infancy, it was impossible to attend to every thing. Our farmers, therefore, very judiciously turned all their attention and devoted all their energies to matters of most importance. The means of maintaining good stocks of cattle are already greatly increased, and we doubt not, in a few years, that the dairy will be a fruitful source of profit.

Implements.—For breaking land, the McCormick plough is a very general favorite. Parker's thrashing machine is considered decidedly the best in use amongst us, and the only obstacle to its universal adoption is its cost. Hussey's wheat reaping machine has been introduced on one of the Brandon estates, but owing principally to its inability to work when the wheat is damp from rain or dew, no material advantage has yet resulted from it.

Obstacles to agricultural improvement—1. Whatever tends to divert into other channels labor or capital which would otherwise be employed in farming, is an obstacle to the advancement of agriculture. In the southern portion of the county, the getting of staves, timber, shingles and lumber of every variety, for all of which Petersburg affords a ready market, engages the attention of many of the farmers, and occupies time and labor, which they would otherwise be forced to devote to their farms. On the river, in like manner, the early profits as well as the irregular life of the fishermen induce many smaller proprietors to neglect the culture and improvement of the soil.

2. The country stores which are licensed by court are too often little else than tippling-shops. They serve to attract the idle and dissipated, to corrupt our negroes, and not unfrequently become the receptacles of stolen goods.

3. One of the main obstacles to improvement is the want of free intercommunication of ideas and opinions between farmers. We often see the most important operations managed differently by different farmers, and of course with different results. Now there must be a *best* way for doing every thing, and it is the interest of every farmer to find it out. Agriculture, in comparison with other sciences, labors under the great disadvantage that often a series of years are required for the performance of the simplest experiments. Take for example the subject of rotation, and from three to six years must elapse before the advantages of a particular rotation can be tested, and as many more for them to be fully confirmed. In chemistry or natural philosophy, on the contrary, as many days or perhaps as many hours would suffice for the settlement of the most important principles. Hence no one man can ever expect in an ordinary lifetime by himself, and depending on his own exertions and resources, however ample they may be, to perfect or greatly improve any system of agriculture. How is this difficulty to be remedied? By giving each farmer all the advantage of the experience of his brother farmers. The best means of effecting this would be the organization of properly constituted agricultural societies throughout our land. Every farmer should become a member of such society, and furnish his mite of experience for a common fund for the advantage of all. If every county had its society, and there existed a free correspondence and interchange of views and opinion between them, each member would be benefited by the experience of every other farmer in the state.

4. The last and most important obstacle to agricultural improvement, to which your committee will refer, is the want of governmental aid. The fact is notorious that our legislature has heretofore done almost nothing for agriculture. While such has been the case here, it has been far different in some of our sister states. The legislatures of the New England states, of New York, Pennsylvania and Ohio, actuated by more enlarged views, have all taken this important subject in hand. Under their fostering care agriculture in their respective states has advanced with the most rapid strides. Like effects follow like causes, and here as there, could the same action be induced, the same result would certainly follow; and have our farmers no right to expect such action? It is an axiom universally admitted that all the burthens of society rest finally on the shoulders of the producing class—the farmers pay all the taxes, they bear all the burthens of government. And what, it may be reasonably asked, has government done for the farming interest? Is it not strange, in a country purely agricultural, and where all power rests with the cultivators of the soil, that in the legislative hall the agricultural is the only interest unprovided for. Laws are enacted for the benefit, and agriculture taxed in support of the commercial, mechanical, and worse than all, the paper bank system. Colleges are instituted and universities endowed to educate the lawyer and the physician, but ask for so much as an agricultural school or experimental farm and the idea is scouted from the hall. Farmers of Virginia! This should not be so. It is your fault rather than the fault of your legislators. The people must first move. Bring about the right feeling at home, and the legislature will yield ready obedience.

Much can be done by our legislature in aid of agriculture. All unnecessary burthens must be removed. Due encouragement must be given to the formation of agricultural societies. The Board of Agriculture must be fostered and furnished with the means of extending its usefulness. An agricultural survey, as conducted in Massachusetts, would be attended with the happiest effects. Agricultural schools and pattern farms, established in different sections of the state, would be highly beneficial. By judicious legislation, the country might, in the course of a few years, be cleared of many vegetable pests which individual exertions can never eradicate. On Blackwater and other similar streams lie thousands of acres of now useless swamps, which by the concerted action of all the proprietors could be made fertile and valuable land. This can only be brought about by legislation. The law of enclosures, a good and wise enactment, and one well suited to the country at the time of its adoption, has, by a change of circumstances, become a grievous burthen, and needs alteration. Much time and expense is now annually devoted to making and repairing fences which would otherwise be devoted to the improvement of the soil.

All of which is respectfully submitted.

THE APPOMATTOX LANDS OF PRINCE GEORGE COUNTY.

[The following notes were prepared by request of the committee by one of its members who is a proprietor and cultivator in the small section of the county described, and which section has a peculiar character, and being almost isolated, is but little known except to its residents, and was not embraced in the foregoing general report. These notes were not sent in until the report had been adopted by the society, and when the action and authority of the committee were at an end. The secretary of the society has therefore sent it with the report, and it is here appended.—Ed. Far. Reg.

This part of the county lies between the Appomattox river and City Point road from Petersburg as far as Broadway, which is four miles above City Point. The formation of the country is beautiful. The range of hills which leave the river above Petersburg, and at the foot of the falls, approach it again below Athol, (a distance of five miles) forming nearly a semicircle. They contain within their enclosure a bottom of perhaps three thousand acres, to the soil of which it is difficult to give a general designation, being sandy, mulatto, and pipe clay alternately. Of this nearly the whole is in cultivation, for the fences are kept up and fuel is supplied from the woods of the neighboring hills. From the hill or hills the land is an inclined plane to the east, for a mile or more, varying very little. Though the surface water, finding no natural vents, accumulates in many of the lowest places, and these are (very improperly) called swamps. High land and low land is every where well supplied with springs of the purest fresh water. Pine, oak, gum, chestnut and cedar are, I believe, found in abundance. The good timber for houses has long since been consumed in Petersburg. No reasonable fear can be entertained that there will ever be a scarcity of wood for fencing and fuel, as the quick growth of the pines forbids it. I have been told by a gentleman near me that he has sold the successive growths of pine from the same piece of land three times since he owned it. Within the bounds assumed I do not think more than one-third of the land is cultivated. Petersburg is a good market for corn-shucks and hay, consequently the cattle are few and small. Few horses are raised, and only four persons have sheep, and their flocks are small. No disease among the cattle prevails here.

As the object of the society is to know the available means of improving the land in each section of the county, I shall confine myself to that only, leaving all other subjects of inquiry to those members of the committee who are generally acquainted with the county, and who must be better informed on them than one who is comparatively a stranger.

Marl has not been found above City Point, nearer than two or three miles, (in this county.) We have several reasons to be satisfied with our location, from the low price of oyster-shells and the success which has attended the application of lime to every soil in this part of the county. Mr. Herbert Whitmore's farm, and Mr. Marius Gilliam's, have in a few years put on a new face, and land that was thought worthless, is now well set in clover, and the crops of corn, wheat and oats are four or five times what they would have been under the old plan. Shells can be bought in Petersburg for 37½ cents the hogshead, (18 bushels,) or one dollar delivered on the farm, and on the spot they are to be burned. Three hogsheads will lime a little more than an acre at a peck to 36 square yards. They lose nearly a third in burning. On that beautiful but neglected little farm, Mount Airy, the property of Mr. Nolting of Richmond, shell lime applied in 1828, and the land cultivated by tenants every year since, can now be plainly seen in the superior size of the crop. Some of the members of the committee know the fact that manure is cheaper in Petersburg than in any town in the Atlantic states, and that six loads of manure can be paid for by a load of wood, the wood and the manure being hauled by the same team, going and returning. A farmer finds a ready market, at a fair price, in Petersburg, for every thing that is food for or can add to the comfort of man or beast.

Draining is another means of improvement which I deem it proper to mention. A sub-stratum of pipe-clay or fuller's earth underlays most of the county east of the Broadway road, which prevents the rain water from sinking, and on the surface there are few natural vents, the land being level, consequently the water accumulates in the lower places, which are improperly called swamps, and are thought to be of no value. The land is soured, and when cultivated produces nothing without draining. A few years ago Mr. John E. Meade drained a piece of this kind of wet land, on the City Point road, by surface drains four or five feet at top and a few inches at bottom, across which the ploughs could easily

pass, and effected by this cheap way of draining, a complete change in the color, texture and product of the land. This land when drained produced eight barrels of corn, its product before had been three. This operation is performed by the plough. I cannot but think that these lands are well suited to grass, and have been surprised to see no artificial grasses here, and only a few small meadows of natural grass.

Minerals have not been found in this part of the county. All the earths from which the ingenuity of man has moulded pots and pans abound here, (and I make no doubt porcelain among them,) with wood as cheap as could be asked; and yet there is but one pottery in all the county. We have no manufactures. I have not yet seen a grist mill or a blacksmiths shop. Petersburg supplies us with every thing.

GRADED HILL-SIDE DITCHES.

To the Editor of the Farmers' Register.

In the February number of the Register, p. 88, I find an article headed "Scraps of farmers' conversation, by the editor." The conversation of Mr. Old I propose to notice. He is opposed to the system of graded hill-side ditches as a preventive to the washing of the land in heavy falls of rain, because they will not effect the object desired—that on a hill-side having several ditches, if the one near the top should break, the quantity of water thereby increased in the next, together with the force with which it would descend, the second would break, and, for the same reason, all the rest; consequently more injury would be done to the land than if they had not been made. He gives an instance of one of his ditches, that he had been so particular with as to attend to in person, having been broken by the lodgment of a few blades of fodder, which seems to be conclusive that the system was a bad one. If Mr. Old had given the grade and depth of his ditches, we should have been better able to form an opinion whether he had given the plan a fair trial or not; but we are left in the dark in these particulars, as well as to the distance between them and the manner his rows were laid off; whether in checks up and down the hill, or drills parallel with the ditches, or horizontally. For the last ten years I have practised the system of graded hill-side ditches, accompanied with the horizontal cultivation, as I believe with great success in preventing my land from washing. I must, therefore, ask leave to differ with Mr. Old. If our fields were perfect inclined planes, it would be a very easy matter to so run our rows as for each to bear off its own water so gently as not materially to wash the land. This, however, being far from the case, the question is, the best protection under the circumstances of the many undulations that we find in even a small field. It is the practice of many farmers in this section of Georgia to put in the necessary number of ditches and lay off their rows parallel with those ditches and cultivate the crop in drills. The argument for this practice is, that the rows, having the same grade of the ditches, will mainly bear off their own water. They forget that the natural undulations will very soon vary the grade, in fact change the direction of the water in different points of the row; it is therefore embodied and presses its way down the hill to the ditch below, drives across that and materially injures the land. The reason for the imperfection of this system is obvious. In one part of the field the hill may be very abrupt, at another less so, and at another still less. A ditch passing across all these various declinations, ascending the hollow on one side and descending it on the other to the natural eye, but by the instrument keeping the same grade. Now it is very easy to perceive, that in a parallel of thirty feet from the ditch, you would lose your grade, for the reason, that the fall, supposing the parallel on the lower side of the ditch, would be much greater where the hill was very abrupt, than where it was less than half as much so. Therefore the parallel row would be many inches out of the grade of the ditch at the steep part of the hill, and as compared with the ditch where the land was less abrupt. Hence the water would be thrown into bodies by this method of operation, to say nothing of the many smaller undulations, almost imperceptible to the eye, producing the same effect. And when once sufficiently embodied, the volume continues to increase, and it soon defies obstruction.

It cannot be difficult for any one who has ever used a level to comprehend the force of this reasoning. It has been observed, that if fields were perfect inclined planes, it would be a very easy matter to have each row pass off its own water. Now the horizontal rows form an inclined plane taking the rows together. True the direction of the plane is changed as often as the direction of the level changes, nevertheless the same grade is preserved, measuring from the top of one bed to the top of the other; therefore the direction of the plane is changed as often as you have undulations in the land. Your level being perfect, of course your inclined plane is perfect, and when you have such a fall of water as to overrun your water-furrows, it is as apt to break over on a ridge as in a valley; for the rows being level, the water remains where it fell—the inclined plane being perfect, the water passes over in a kind of sheet, until received by the ditch below, and by it borne off. To keep your level perfect, short rows will occur between your guide furrows; because where the land is most abrupt, the guide furrows will be nearer together than where it is less so, by running rows about parallel with the guide rows the place for the short rows will be indicated by the filling of the space where the land is most abrupt; the remaining space will then be to fill with short rows by the judgment of the operator.

But to the ditches. A field that is intended to be ditched should be sown in small grain, in order to have as smooth a surface to operate on as possible. The ditches should be from 75 to 150 yards apart, regulated in their distance apart by the fall of the land, and the ability of the soil to absorb water. In fields laying comparatively well, in many cases three or four ditches are sufficient for a field of fifty acres, of which the operator must be the judge. The grade may be regulated by the ability of the soil to absorb water, giving greater fall on clay lands, and less on sandy porous soils. For land having average ability to absorb water, my grade is *three inches to twelve feet*, increased or diminished a quarter of an inch, as the soil is more or less capable to absorb water. The

instrument used is the common rafter level, having a stride of twelve feet, with a plumb bob suspended from the crown by a very small cord, so boxed as to prevent the influence of the wind. The grade is indicated by a mark on the cross-bar, say two and a half feet from the crown. The grade that you may wish may be ascertained by first finding a perfect level. This is best done by reversing the ends of the instrument, until the plumb-line will stand at the same point on the cross-bar. Then place under one end of the level a block just the thickness that you wish your grade, and the plumb-line will indicate the declination on the cross-bar. I usually commence operations near the highest point of the land and in the middle of the intended ditch, and let that point divide the water, having it to run each way. By this method I encounter a less volume of water at any one point. The ditch being marked out by a chop with a hoe at each step of the level, it is opened by running several furrows with a plough, and the dirt drawn out on the lower side with weeding hoes. I prefer the ditches wide rather than deep, and concave in the bottom. A plough may pass them without inconvenience, and they occupy about the space of one corn-row. The necessary number being laid out and opened, you may proceed to lay out your guide furrows, by the mark that indicates the true level. The space between the guide furrows will be filled by running parallel rows alternate to the guide rows, the width that you may desire, for either corn or cotton, until the space is filled, finishing with short rows where they may be required, as before directed. The land is then thrown into beds by the rows, the beds opened, and the crop planted. In the cultivation, if the level is well preserved in the rows, and the water-furrows kept well open, all the water will be retained in common rains; but if the rain should be so great that the land cannot absorb it, nor the water furrows hold it, it passes over the bed in a sheet—because of the inclined plane formed by the horizontal rows—and is received by the ditch and borne off. If the grade of the ditch is a proper one, and well preserved the whole length, and properly opened and well attended to the first year, when a turf will be formed on its bank, I will ensure it not to break by the lodgment of a few blades of fodder.

The reason that hill-side ditches are in disrepute with many is because the grade is not a proper one, or not well preserved. In one part of the ditch, the grade being too great, the water passes too rapidly; in another, not being great enough, it passes too sluggishly: consequently there must be an accumulation at the point where the water moves slowest, and the volume continues to increase until the ditch is overflowed, for which the system is condemned, when the true cause is in the operator. I have seen many fields injured from improper ditching, but it has not proved to me that the system is a bad one. If Mr. Old will give us a statement of his method of operation, and cogent reasoning why the system of graded hill-side ditches is a bad one, and point out one that is better, and sustain it by incontrovertible proofs, for myself I will most cheerfully abandon the one and embrace the other.

Of one thing I am certain, that my land washes less than my neighbors' who have not resorted to the means that I have to prevent it; and I believe that many of them are finding it out, from the fact that they have commenced the system of graded ditches.

Since writing the above, I have had on my farm a very hard and washing rain, when the land was not guarded against it. Soon after the rain a field was examined that came into my possession last winter, and in the spring the necessary number of ditches had been made in it, and no attention given them since. By the way, it is a very broken field, and many gullies had been formed, across which the ditches passed as a matter of course. The crop is corn, and cultivated horizontally. I found the field well preserved. Even in the gullies across which the ditches passed, the loose dirt which fell from the ploughs in crossing them had not been washed out. I confidently expect, by filling these gullies with pine bushes, which I shall do this fall previous to sowing wheat, to have these gullies entirely filled, and corn growing on them.

My object in noticing the conversation of Mr. Old is to elicit information on the subject of preserving hilly land from washing from the heavy falls of rain, frequent in this country during the crop season, and as the gentleman condemns the system that I have practised with success, as I believe, I felt called on to vindicate it, and at the same time ask him for a better and more effectual one.

R. S. HARDWICK.

Jocassie, Hancock county, Ga.
June 28th, 1842.

CEREAL PLANTS.

Mr. Editor:—A short time back, I sent you an article on wheat and Indian corn, taken from the chapter upon the grain crops of France, in Le Bon Jardinier; I now send you the rest of that chapter.

LES PLANTES CEREALES.

Alpiste, Canary grass, Phalaris canariensis.—An annual plant resembling the millet in its culture and use. Its hay is a good food for horses and horned cattle. It should be sown thin, broadcast, in April or May, on a good light and rich soil.

Avoine, Oats, Avena sativa.—This grain presents a great number of varieties, the respective merits of which it is difficult to determine, their success and quality depend very much on the soil and climate. I will here point out the chief varieties, observing at the same time that it is only by experiments made upon his own land, that one can best judge which to prefer.

Avoine patate, Potato oat, Avena sativa turgida.—Grain white, short, heavy, having a fine husk and being very farinaceous. This variety, for many years very much sought after in England, preserves here with difficulty those qualities which cause it to be so much esteemed in that country. It is very subject to the black head, yet in many experiments, it has shown itself superior to our common oat.

Avoine de Georgie, Avena sativa georgiana.—Grain of a yellowish white, very large and heavy, having a hard husk; head very large; leaves of

considerable size; straw stout and tall but sweet and of a good quality for cattle; matures very early; it furnishes when thrashed more grain than any other variety.

Avoine Joanette, Avena sativa varietas.—Has been cultivated for some little time in the environs of Orleans on account of its precocity. It is apt to shatter, and for that reason must be cut a little before attaining maturity. Grain black and good.

Avoine de trois graines, Avena trisperma.—Thus called because its meshes are generally composed of three grains, attached to each other at the base; very productive and not difficult to suit with a proper soil; grain quite large but bearded and with a hard husk; quality not above mediocrity.

Avoine noire de Brie.—One of the best varieties, and very productive in good lands; grain short, plump and good in quality. A part of the grains are not separated in thrashing, but remain joined two together at their base.

Avoine d'hiver, Avena sativa hyemalis.—Very much esteemed, and grown in Britany and a part of the west of France, but its success is uncertain in the east and north, where the cold injures and sometimes destroys it; very productive in straw and grain, which is heavy and of an excellent quality, it matures early. They sow it in September and the commencement of October, in countries where they fear not the winter; in others it may be usefully employed. Thus in some parts of Berri, they sow it in February, and even in the last of January, which quality renders this variety more certain than the spring oats.

Avoine de Hongrie, Avena orientalis.—There are two varieties, the black and the white, entirely different from all other oats in having their heads bound up, and all the grains closely attached, and hanging from a single side, which causes it to be called the cluster oat, (avoine de grappe.) The black is extremely productive in good land; M. le Viscomte de Morel-Vindé has obtained from it the most wonderful yields and has contributed largely, by his writing and example to the extension of its culture. The grain of this oat is generally rather indifferent and light, and is apt to burn; in short on poor land I find it inferior to the common oat, despite however of its defects, its great product in straw and grain cause it to be in many places preferred above all others. The white Hungary oat is particularly remarkable for the strength and height of its straw, the grain is often even inferior in quality to that of the black variety. Yet I have for some time cultivated a sub-variety without or very rarely with a beard, the grain of which is good and nutritious. It produces fully as abundantly as the other in good land, and better than the black in bad land; both are hard to thrash and the straw is not a good food as that of the other varieties.

Avoine nue, Avena nuda.—Remarkable for its meshes composed of four or five grains hanging in a small cluster, and for its grain being without chaff, and which may be thrashed entirely clean. The product is small and the grain indifferent. M. Ardent has within a few years introduced a larger variety, a part of the grains of which, however, are not naturally without chaff. The peculiar nature of these two varieties seems to make them more fit than any others for oat meal, but I do not know that any attempts have been made to discover if such preference existed.

Grosse Orge nue, Hordeum distichum nudum.—This variety has a considerable advantage over the common barley, in the quality of its grain, which is as heavy and even more so than that of wheat, and which, at the mill, returns nearly its entire weight of flour very superior to that of the ordinary barley. This good quality would without doubt have long since rendered its culture general, had it not possessed defects equally remarkable, such as having a straw as brittle as to render it difficult to thrash it, and having the grain to become dark if the harvest is retarded by a moist spell, which does not injure the quality of the other kinds. Notwithstanding these faults, some farmers sow it in many cases in preference to any other. It is a spring variety and very early.

Escourgeon de printemps, Hordeum vulgare.—Despite the signification of its Latin botanical name, this species, spread over Germany and the north of France, is at present unknown in the most of our departments. It is the earliest of the barley, which adapts it peculiarly to late sowing, for instance the last of May and in June. It is desirable on this account and from its aptitude to succeed on poor land.

Petite Orge nue, Hordeum vulgare nudum.—It is also called *Orge nue à six rangs*, (six headed barley.) Although long known in Europe it has been but little grown until of late, when they have increased it in Belgium under the improper names of *blé de Mai* and *blé d'Egypte*, it is more productive than the *grosse Orge nue*, and its straw is taller. From many experiments in Belgium it may be regarded as an excellent grain to cultivate. It may be sown with success at the commencement of May.

Orge Eventail, Orge riz, Hordeum zeocriton.—Has the peculiar merit of succeeding on indifferent lands and in cold situations. It is well known in Germany, but little known in France. In 1818 this barley produced considerably despite the drought. The grain is very heavy and is superior in quality to that of any of the other varieties.

Orge noire, Hordeum vulgare nigrum.—This species distinguishes itself from all others as well by its manner of vegetating as by the color of its grain. According to the temperature, or more particularly according to the time of sowing, it presents one year with another very perceptible differences, sometimes producing a very good crop of straw and grain, as I proved in 1821, again not compensating one for the pains of sowing it. Experience has shown that sown in the climate of Paris, it will not grow if sown later than the 15th of April; it is best to sow it during March. If sown in the end of April or in May, the tufts keep themselves green the entire year, passing the winter and growing off in the ensuing spring. I have tried sowing it in the autumn, but it perished entirely. What appears to me most remarkable in this plant is its slowness in growing, which renders it almost biennial, and which would permit it (at least in the north of France, it seems to me) to be sown in the end of April or in May, and to serve for grazing the first and to yield grain the next. If any one should make an experiment as to this particular, it would be well to make comparative attempts with this, the

rye Saint Jean, the common rye and the late wheats.

Millet à grappe, Panicum Italicum, and *Millet commun, Panicum Miliaceum.* The culture and use of these two plants are very similar. Neither of them is much cultivated as food for man except in the middle of Europe. They require good land, rather light than stiff, and well worked and manured. They sow them broadcast, thin, and rather late, that is, after the first frosts. It is well to work and weed them. They can furnish a good green food if thickly sown. I have seen the last used thus. The straw also, particularly that of the latter, is an excellent food for beeves.

Moha de Hongrie, Panicum germanicum. Another plant of the same family, which has been for some time introduced into France and cultivated about Metz, under the name of *moha,* which it bore in Hungary. Its benefits have been set forth, in a notice published in the agricultural journals, with a little enthusiasm. Although I put faith in these results as announced in these writings, yet I must say that I have never derived such advantage. Since 1820 I have cultivated the *moha,* given me by M. de Borda. Comparative experiments with the *millet à grappe* have convinced me that it is superior to that as forage, on account of the greater number of smaller stalks; but I have obtained it vigorous and abundant but once, then upon a fertile sand, fresh and well manured. Large crops sown on chalky land of good quality have turned out but poorly. It is then, if I do not deceive myself, only on very good bottom land that this plant can be considered a valuable resource as forage. In respect to the utility of its grain, I think that it may be classed with the *millet à grappe.* I would advise the amateurs who wish to try the *moha* to sow it comparatively with this plant, and to establish between them a parallel which would turn to the advantage of the practical farmer.

Riz de Carro, or *Riz sec de la Chine, Oriza sativa mutica.*—Among the numerous varieties of rice cultivated in India and in certain parts of America, there are some which when sown in the rainy seasons succeed by the aid of that circumstance on elevated ground and without the help of inundation. These are called dry or mountain rice. The attempt to naturalize them has been frequently made in Europe, but more especially in Piedmont, where the unhealthiness of the inundated rice fields destroyed a large portion of the inhabitants of certain villages. These attempts have always been unsuccessful. The *riz de Carro,* a forward and interesting variety, alone gave some hopes of success, which however have not as yet been realized. Nevertheless, the agricultural journals have frequently announced the entire success and complete harvest obtained from the culture of this rice in many of our departments. It is necessary to inform the amateurs in the culture of rare plants that these announcements were founded on a mistake in the species of plant. I have received many samples of this supposed dry rice, and they have uniformly proved to be the *petite epeautre* (*Triticum monococum*) which is now called *Engrain* or *Aingrain* and cultivated as a resource on poor lands in parts of Berri.

To warn farmers against the mistake here recounted, it suffices that the true rices all have pendent heads, like the *Millet des oiseaux* (*Panicum miliaceum*) and the common oat; whilst the *petite epeautre* has an erect and flat head, the grains of which are placed in two rows, like the barley.

Sarrasin, Blé noir, Baralin, Bucail, Buckwheat, Poligonum fagopyrum. Buckwheat is generally a resource for poor countries and sandy lands that are cold and indifferent. It offers advantages also which might cause it to be used with profit on soils of a better nature. Its grain is very abundant, and, as is known, serves as food for man, but still better for fowls and pigeons; it is excellent to fatten hogs on, and to feed horses, while its flowers furnish an abundant pasture to bees. This plant turned in when in flower is esteemed by many practical men as one of the best of the ameliorating vegetables. The vegetation of the buckwheat is also very rapid, and it may be sown late, thus offering a valuable resource as an auxiliary harvest. They generally sow it broadcast; but when the land is very moist they throw it up into beds, because it suffers from humidity; it dreads still more the late frosts, and it is necessary that it should not be sown until the season for them is past. They use a half *hectolitre* of seed to the hectare when it is sown for a crop of grain, and an entire hectolitre, when it is to be turned under. The ashes of the stalks contain much potash. This plant flowering for a long time, its first grains fall before the last are matured, they are therefore obliged to choose a mean time between them for the harvest.

Le Sarrasin de Tartarie, Polygonum tataricum, the grain of which is inferior in quality, is more hardy and less susceptible of cold; the plant is larger, more branching and more productive in grain. It succeeds well in very indifferent lands, particularly in those of Sologne; it may be sown either earlier or later than the common variety, and requires less seed. The buckwheat cut green has been mentioned in many works as a good forage, and I have cited it as such in many editions of the *Bon Jardinier.* Although this use of it is not uncommon, and I myself have more than once fed it to my beeves and cows without perceiving any bad effect; yet it appears that we should distrust this food, for many observations have shown that if given abundantly, either in the stable or in the pasture, it will produce vertigo and other serious diseases. This effect has taken place in horned cattle and sheep. It has been recently reaffirmed in respect to the latter by M. Vuitry of Sens.

Seigle de Mars, Spring rye, Secale cereale vernum, has a straw finer and not so tall as the autumn rye; its grain is smaller, but heavy and of an excellent quality. Its culture has been much extended in the last few years. As its name indicates, they sow it in March. I have obtained from Germany a variety taller and with longer heads and rather later than that of France.

Seigle du nord is a variety of the autumn rye which is distinguished by the length of its straw and its heads, its grain is shorter and smaller, it is later and sends forth more shoots. In Saxony they sow it about St. John's day (from which circumstance it takes the name of *Seigle de la St. Jean,*) and cultivate it at once for forage and grain. They cut it as green food in the autumn, or make pasture of it until the end of winter, and in the ensuing summer they reap it for the grain.

It is not necessary, however, that it should be sown this season, for like the common variety it may be sown in the autumn and will be ready to be cut in the following summer. It is known that the common rye may like the *seigle du nord* be sown in summer with analogous results; the difference between the two kinds in this point has not been yet entirely established.

It is however perfectly well known that the *seigle du nord* is very valuable on account of its great vigor, and it deserves to be tried comparatively with our common variety, both as grain and forage. On account of the smallness of its grain and the size of its shoots, it requires one fifth part less of seed than the common variety.

Sorgho, Broom corn, Holcus sorghum.—This grain grows only in the middle parts of France, and even there offers but small inducement to its further cultivation, because it is an indifferent food, and requires good soil. They give it to the fowls, although some accounts are unfavorable to it as food for them. This plant may be used as green food. In parts of Anjou they cultivate it to make brooms of the branches composing the heads of the plants. They sow it late because it is apt to be injured by frost, and thin because it grows almost as large as maize. The *Sorgho blanc* is larger and more farinaceous than the ordinary variety, but it is later and matures with difficulty in the climate of Paris.

For the Farmers' Register.

TIME OF RIPENING OF WHEAT ON THE NORTH SIDE OF RAPPAHANNOCK RIVER, 18 MILES BELOW FREDERICKSBURG, AND ABOUT 50 MILES NORTH OF RICHMOND, FROM 1831 TO 1842.

1831. 21st June, began harvest with a few cutters—23d, with all hands.

1832. 23d June, cut early wheat—28th, began to cut purple straw in spots—July 4th, all hands in harvest.

1833. 14th June, began to cut early wheat—22d, began bearded and purple straw—24th, all hands in harvest.

1834, 20th June, began to cut early wheat—22d, began bearded and purple straw—24th, all hands in harvest.

1835. 1st July, began to cut early wheat—2d, golden chaff—6th, all hands in harvest.

1836. 22d June, began to cut early wheat—5th July, all in harvest.

1837. 30th June, began to cut early wheat—3d July, all in harvest.

1838. 19th June, began to cut early wheat—29th, a few hands cutting—2d July, all hands.

1839. 17th June, began to cut early wheat—24th all in harvest.

1840. 12th June, began to cut early wheat—19 h, cut Delaware or red German wheat—22d, all hands in harvest.

1841. 28th June, began to cut the ordinary wheat, having ceased to raise early wheat.

1842. 21st June, began to cut the ordinary wheat.

It will be observed, that our harvests have generally followed one week after those recorded in the June number of the Farmers' Register. The extremes are (excepting the early wheat) in 1833 and 1840 on 22d June, and in 1836 on 5th July, an interval of 13 days.

The crop of 1831 was small—crops of '32, '33 and '34 pretty good—of '35 and '36 very bad—'37 and '38 good—'39 indifferent—'40 and '41 pretty good—the crop of the present year is injured excessively by rust, but we cannot know the extent of the injury until it is thrashed. An estate on the Potomac, where the largest crop of the county was expected, will barely, it is thought, yield its seed. Half crops, or two-thirds of crops are anticipated by the most sanguine farmers.

E. T. T.

King George, 9th July, 1842.

THE CROTON AQUEDUCT FOR SUPPLYING WATER TO THE CITY OF NEW YORK.

From the New York Tribune.

This stupendous structure is now completed, and in a few weeks, at furthest, the city will have a foretaste of the thousand benefits it is destined to confer. Our citizens may not be generally aware, that in this magnificent work they are surpassing ancient Rome, in one of her proudest boasts. None of the hydraulic structures of that city, in spite of the legions of slaves at her command, equal, in magnitude of design, perfection of detail, and prospective benefits, this aqueduct. The *main trunk* consists of an immense mass of masonry, six feet and a half wide, nine feet high, and forty miles long, formed of walls three feet thick, cemented into solid rock. But this water channel, gigantic as it is, is far from being all the work. The dam across the Croton, which retains the water in a grand reservoir, is a mound of earth and masonry, forty feet high, and seventy feet wide at the bottom, and has connected with it many complicated, but perfect contrivances, to enable the engineer to have complete control over the mighty mass of water. The river, thus thrown back towards its source, will form a lake of five hundred acres, which will retain a supply for emergencies, of some thousand millions of gallons, and also offer, as a collateral advantage, many picturesque sites for country seats, upon the woody points which will jut out into its smooth basin. A tunnel leads the water from this reservoir into the aqueduct, and eleven more of these subterraneous passages occur before reaching Harlem river, having an aggregate length of seven-eighths of a mile, and many of them being cut through the solid rock. At intervals of a mile, ventilators are constructed in the form of towers of white marble, which give to the water that exposure to the atmosphere, without which it becomes vapid and insipid: and these dazzling turrets mark out the line of the aqueduct to the passengers upon the Hudson.

The streams which intersect the line of the structure, are conveyed under it in stone culverts, the extremities of which afford the engineers an opportunity of displaying their architectural taste. Sing-Sing creek, with its deep ravine, is crossed by a bridge of a single eliptical arch of eighty-eight feet span, and a hundred feet above the stream. Its unusually perfect workmanship was proved by its having settled but one inch after the centres were removed. The view of its massive

grace, from the narrow valley beneath, is one of the most striking points upon the line. Sleepy Hollow, well known to the readers of imaginative lore, is spanned by a series of graceful arches.

The bridge crossing Harlem river has been the subject of much controversy. The admirers of magnificent symmetry and perfection, and those interested in preserving the navigation of that stream, have warmly advocated the erection of a bridge, over which the water might pass upon its regular level; while the friends of more measured economy recommended a lower and cheaper structure, to which pipes should descend and rise therefrom, after the manner of an inverted syphon. The plan finally adopted is that of a high bridge, but still with its surface ten feet below the usual grade, which falls fourteen inches to the mile. It is a quarter of a mile long, one hundred and sixteen feet above high water, and its estimated cost exceeds three-quarters of a million. Across this the water is conveyed in huge iron pipes, protected from the frost by a covering of earth, four feet deep. Near Manhattanville is a tunnel a quarter of a mile long, through the hill at that place; and its valley is crossed by pipes, descending one hundred and five feet. Clendenning valley is passed at an elevation of forty feet, and arches of appropriate size upon the lines of the streets, leave symmetrical carriage-ways and foot-paths.

We paid a brief visit yesterday to the two great reservoirs of this stupendous aqueduct. The receiving reservoir, at Yorkville, thirty-eight miles from the dam at Croton river, is in two divisions, both covering a space of thirty-five acres, capable of containing one hundred and sixty millions of gallons. It is enclosed by granite walls of solid masonry, roughly finished. The bottom of the basin is the natural soil.

The distributing reservoir at Murray's Hill, in Forty-second street, is a much finer and more expensive work. It is nearly square, and covers an area of about five acres. The bottom is made of puddled clay, as smooth, hard and water-tight as marble itself. This area is 440 feet square at the base, and is divided in the centre by a wall of granite, nineteen feet thick at the bottom, and four at the top. It is surrounded by a wall, also of granite, composed of three distinct columns of solid mason work. The outer column is five feet thick; the second six, and the third, or inner one, a lining of granite, about fifteen inches in depth, placed upon a concrete masonry, above thirty feet thick at the base. From the outside to the middle wall—the thickness of neither included—the distance is fourteen feet; and from the extreme of the outer wall to the inner angle of the third, is sixty feet—the three walls uniting at the top. At a distance of ten feet from each other, are thick cross walls with solid arches thus binding the whole into one solid, imperishable mass. From the top of the north-east cornice to the level of the street, the distance is fifty-six feet. The depth of the reservoir is forty feet; and it will contain water to the depth of thirty-six feet, or about twenty-two millions of gallons—as computed a few days since by James Renwick, Jr., one of the engineers employed on the work.

At the east end of the division wall, a well has been sunk to the depth of fifty feet, communicating with a sewer below, and forming a waste-wier for the discharge of the surplus water, when it rises in the reservoir above the height of thirty-six feet. At the bottom of the well is laid a block of granite, weighing seven tons; and still further to break the fall of the overflowing stream, and to prevent it from wearing away the stone, water to the depth of six feet rests permanently at the bottom. From the well the waste water is conveyed by a sewer nearly a mile to the North river.

The style of architecture is Egyptian—well fitted by its heavy and imposing character for a work of such magnitude. The summit of the walls around the whole area, is flagged, and will be provided with a heavy iron railing, forming a beautiful and sightly promenade, twenty feet in width. The grounds immediately around the work have been purchased by the corporation to protect it from encroachments. The receiving and discharging pipes are two in number, each about three feet in diameter. It is now nearly four years since the reservoir was first commenced, and during the working season, on an average, about four hundred men have been constantly employed upon it, besides great numbers employed in the winter season in bringing materials. During the whole time no lives have been lost by accident. Two men had their legs broken by a downfall of the banks—and this is the extent of the injuries that have been sustained. The whole cost will not be far from $500,000.

Such is a condensed but comprehensive view of this noble structure. It is now completed, with the exception of the high bridge. The bridge will occupy two years more, but a temporary pipe has been laid over the river upon the coffer-dams of the bridge, which will afford us a supply of water for two or three years, until the completion of the entire work. Its estimated cost, owing to the changes of plan, rise of labor and provisions, &c., has risen from five to twelve millions—a great sum abstractly considered, but a trifling one compared with the benefits resulting from the work.

ABSTRACT OF PROFESSOR LIEBIG'S REPORT ON ORGANIC CHEMISTRY APPLIED TO PHYSIOLOGY AND PATHOLOGY.

From the Albion.

This paper, read by Dr. Playfair, is so excellent a review on Liebig's volume, and contains so much matter of the highest importance as relates to organic chemistry, that we are induced to give a connected abstract.

The first part consisted of the examination of the processes employed in the nutrition and reproduction of the various parts of the animal economy. In vegetables, as well as in animals, we recognize the existence of a force in a state of rest. It is the primary cause of growth or increase in mass of the body in which it resides. By the action of external influences, such as by pressure of air and moisture, its condition of static equilibrium was disturbed; and, entering into a state of motion or activity, it occupied itself in the production of forms. This force had received the appellation of *vital force* or *vitality*. Vitality, though residing equally in the animal and vegetable kingdoms, produced its effects by widely different instruments

Plants subsisted entirely upon manures belonging to inorganic nature. Atmospheric air, the source whence they derived their nutriment, was considered to be a mineral by the most distinguished mineralogists. All substances, before they could form food for plants, must be resolved into organic matter: but animals, on the other hand, required highly organized atoms for nutriment. They could only subsist upon parts of an organism. They possessed within them a vegetable life, as plants did, by means of which they increased in size, without consciousness on their part; but they were distinguished from vegetables by their faculties of locomotion and sensation--faculties acting through a nervous apparatus. The true vegetable life of animals was in no way dependent upon this apparatus, for it proceeded when the means of voluntary motion and sensation were destroyed; and the most energetic volition was incapable of exerting any influence on the contractions of the heart, on the motion of the intestines, or on the processes of secretion. All parts of the animal body were produced from the fluid circulating within its organism, by virtue of vitality, which resided in every organ. A destruction of the animal body was constantly proceeding. Every motion, every manifestation of force, was the result of the transformation of the structure, or of its substance. Every conception, every mental affection, was followed by changes in the chemical nature of the secreted fluids. Every thought, every sensation was accompanied by a change in the composition of the substance of the brain. It was to supply the waste thus produced, that food became necessary. Food was either applied in the increase of the mass of a structure (*i. e.* in nutrition,) or was applied in the replacement of a structure wasted (*i. e.* in reproduction.) The primary condition for the existence of life was the reception and assimilation of food. But there was another condition equally important—the continual absorption of oxygen from the atmosphere. All vital activity resulted from the mutual action of the oxygen of the atmosphere and the elements of the food. All changes in matter proceeding in the body were essentially chemical, although they were not unfrequently increased or diminished in intensity by the vital force. The influence of poisons and remedial agents on the animal economy proved, that the chemical combinations and decompositions proceeding therein, and which manifested themselves in the phenomena of vitality, might be influenced by bodies having a well defined chemical action. Vitality was the ruling agent by which the chemical powers were made to subserve its purposes; but the acting forces were chemical. It was from this view, and no other, that we ought to view vitality.

According to Lavoisier, an adult man takes into his system every year 837 lbs. of oxygen, and yet he does not increase in weight. What then becomes of the enormous quantity of oxygen introduced in the course of the year into the human system? The carbon and hydrogen of certain parts of the body have entered into combination with the oxygen introduced through the lungs and through the skin, and have been given out in the form of carbonic acid and the vapor of water. At every moment, with every expiration, parts of the body are thus removed, and are emitted into the atmosphere. No part of the oxygen inspired is again expired as such. Now, it is found that an adult inspires 32½ ounces of oxygen daily; this will convert the carbon of 24 lbs. of blood into carbonic acid. He must therefore take as much nutriment as will supply this daily loss; and, in fact, it is found that he does so; for the average amount of carbon in the daily food of an adult man, taking moderate exercise, is 14 oz. which require 37 oz. of oxygen for their conversion into carbonic acid. But it is obvious, as the inspired oxygen can be removed only by its conversion into carbonic acid and water, that the amount of food necessary for the support of the animal body must be in direct ratio to the quantity of oxygen taken into the system. Thus a child, in whom the organs of respiration are naturally in a state of great activity, requires food more frequently and in greater proportions to its bulk than an adult, and is also less patient of hunger. A bird, deprived of food, dies on the third day; whilst a serpent, which inspires a mere trace of oxygen, can live without food for three months. The capacity of the chest in an animal is a constant quantity; we therefore inspire the same volume of air whether at the pole or the equator; but the weight of the air, and consequently of the oxygen, varies with the temperature. Thus an adult man takes into the system daily 46,000 cubic inches of oxygen, which, if the temperature be 77°, weigh 32½ oz., but when the temperature sinks down to the freezing-point (32°,) it will weight 35 oz. Thus an adult in our climate in winter may inhale 35 oz. of oxygen: in Sicily he would inspire only 28½ oz.; and if in Sweden, 36 oz. Hence we inspire more carbon in cold weather, when the barometer is high, than we do in warm weather; and we must consume more or less carbon in our food in the same proportion. In our own climate the difference between summer and winter in the carbon expired, and therefore necessary for food, is as much as an eighth. Even when we consume equal weights of food, an infinitely wise Creator has so adjusted it as to meet the exigencies of climate. Thus the fruit on which the inhabitants of the south delight to feed contains only 12 per cent of carbon, whilst the bacon and train-oil enjoyed by the inhabitants of the Arctic regions contain from 66 to 80 per cent. of the same element. Now the mutual action between the elements of food and the oxygen of the air is the source of animal heat. All living creatures, whose existence depends on the absorption of oxygen, possess within themselves a source of heat independent of the medium in which they exist; this heat, in Professor Liebig's opinion, is wholly due to the combustion of the carbon and hydrogen contained in the food which they consume. Animal heat exists only in those parts of the body through which arterial blood (and with it oxygen in solution) circulates. The carbon and hydrogen of food, in being converted by oxygen into carbonic acid and water, must give out as much heat as if they were burned in the open air; the only difference is, that this heat is spread over unequal spaces of time, but the actual amount is always the same. The temperature of the human body is the same in the torrid as in the frigid zone; but as the body may be considered in the light of a heated vessel, which cools with an accelerated rapidity, the colder the surrounding medium, it is

obvious that the fuel necessary to retain its heat must vary in different climates. Thus less heat is necessary in Palermo, where the temperature of the air is that of the human body, than in the polar regions, where it is about 99 degrees lower. In the animal body the food is the fuel, and by a proper supply of oxygen we obtain the food given out during its combustion in winter. When we take exercise in a cold atmosphere, we respire a greater amount of oxygen, which implies a more abundant supply of carbon in the food; and by taking this food we form the most efficient protection against the cold. A starving man is soon frozen to death and every one knows that the animals of prey of the Arctic regions are far more voracious than those of the torrid zone. Our clothing is merely an equivalent for food, and the more warmly we are clothed, the less food we require. Were we to go destitute of clothes, like certain savage tribes,—or if, in hunting or fishing, we were exposed to the same degree of cold as the Samoyedes,—we could with ease consume 10lbs. of flesh, and perhaps a dozen tallow candles to the bargain, as warmly-clad travellers have related with astonishment of those people.* Then could we take the same quantity of brandy or blubber of fish without bad effects, and learn to appreciate the delicacy of train-oil. We thus perceive an explanation of the apparently anomalous habits of different nations. The maccaroni of the Italian, and the train-oil of the Greenlander and the Russian, are not adventitious freaks of taste, but necessary articles fitted to administer to their comfort in the climates in which they have been born; and the colder the region the more combustible must the food be. The Englishman in Jamaica perceives with regret the disappearance of his appetite, which in England had been a constant recurring source of enjoyment; by the use of aromatics he creates an artificial appetite, and eats as much food as he did at home; but he thus unfits himself for the climate in which he is placed; for sufficient oxygen does not enter his system to combine with the carbon consumed, and the heat of the climate prevents him taking exercise to increase the number of his respirations. The carbon of food is therefore forced into other channels and disease results. England, on the other hand, sends her dyspeptic patients to southern climates. In our own land their impaired digestive organs are unable to fit the food for that state in which it best unites with the oxygen of the air, which therefore acts on the organs of respiration themselves, thus producing pulmonary complaints; but when they are removed to warmer climates they absorb less oxygen and take less food, and the diseased organs of digestion have sufficient power to place the diminished amount of food in equilibrium with the respired oxygen; just as we would expect from these views, in our own climate, hepatic diseases, or diseases arising from excess of carbon, are more prevalent in summer, and in winter pulmonic diseases, or those arising from an excess of oxygen. The professor then went on to disprove the notion that animal heat is due to nervous influence and not to combustion—an error which had its origin in supposing that the combustion proceeds in the blood itself. He also showed that animal heat must not be ascribed to the contraction of the muscles, but that the heat evolved by the combustion of carbon in the body is sufficient to account for the phenomena of animal heat. He showed that the 14 ounces of carbon which are daily converted into carbonic acid in an adult disengage no less than 197.477° of heat; a quantity which would convert 24 lbs. of water, at the temperature of the body, into vapor: and if we assume that the quantity of water vaporized through the skin and lungs amounts to 3 lbs. then we have still 146.380° of heat to sustain the temperature of the body. And when we take into calculation the heat evolved by the hydrogen of the food, and the small specific heat possessed by the organs generally, no doubt could be entertained that the heat evolved in the process of combustion, to which the food is subjected in the body, is amply sufficient to explain the constant temperature of the body. From what has preceded, it is obvious that the amount of carbon consumed in food ought to depend on the climate, density of air, and occupation of the individual. A man will require less carbon when pursuing a sedentary occupation than when he is engaged in active exercise. Professor Liebig, having thus discussed the source of animal heat, proceeds next to consider what are the ingredients in the food which may properly be considered to be nutritious. Physiologists conceive that the various organs in the body have originally been formed from blood. If this be admitted, it is obvious that those substances only can be considered as nutritious which are susceptible of being transformed into blood. The professor then entered upon an examination of the composition of blood, and of the identity in chemical composition of fibrine and albumen. The nutritive process is simplest in the case of the carnivora. This class of animals live on the blood and flesh of the graminivora, whose blood and flesh are identical with their own. In a chemical sense, therefore, a carnivorous animal, in taking food, feeds upon itself; for the nutriment is identical in composition with its own tissues. He next inquired, from what constituents of vegetables the blood of the graminivorous animals is produced. The nitrogenized compounds of vegetables forming the food of graminivorous animals are called vegetable fibrine, vegetable albumen, and vegetable caseine. Now, analysis has led to the interesting result, that they are exactly of the same composition in 100 parts; and, what is still more extraordinary, they are absolutely identical with the chief constituents of the blood—animal fibrine and animal albumen. By identity, be it remarked, we do not imply similarity, but absolute identity, even as far as their inorganic constituents are concerned. These considerations showed the beautiful simplicity of nutrition. In point of fact, vegetables produce, in their inorganism, the blood of all animals. Animal and vegetable life are therefore most closely connected. The professor has still to account for the use of the substances in food which are absolutely destitute of nitrogen, but which we know are absolutely necessary to animal life. In all these we find a great excess of carbon, and but very little oxygen. By a train of admirable reasoning, he arrives at the interesting conclusion, that they are solely exhausted in the production of animal heat, being converted by the oxygen of

* A sportsman or traveller in the Highlands of Scotland knows how much more he can *whisky it*, &c., than in the south.

the air into carbonic acid and water. This portion of the report contained an ingenious and important view of the use of bile in the animal economy, the truth of which quantitative physiology dare not deny. When exercise is denied to graminivorous and omnivorous animals, this is tantamount to a deficient supply of oxygen. The carbon of the food not meeting with sufficient oxygen to consume it, passes into the compounds containing a large excess of carbon, and deficiency of oxygen; or, in other words, fat is produced. Liebig is led to the startling conclusion, that fat is altogether an abnormal and unnatural production, arising from the adaptation of nature to circumstances, and not of circumstances to nature—altogether arising from a disproportion of carbon in the food to that of the oxygen respired by the lungs, or absorbed by the skin. Wild animals in a state of nature do not contain fat. The Bedouin or Arab of the desert, who shows with pride his lean, muscular, sinewy limbs, is altogether free from fat. And the professor points out the diseases arising from this cause, and furnishes some valuable hints to therapeutics. From all that has transpired, we may sum up the nutritious elements of food as follow. The ingredients adapted for the formation of the blood, and which the professor calls the plastic elements of nutrition, are as follow:—vegetable fibrine, vegetable albumen, vegetable caseine, animal flesh, animal blood. The other ingredients of food, being fitted to retain the temperature of the body, he calls the elements of respiration. They are—fat, starch, gum, cane-sugar, grape-sugar, sugar of milk, pectine, bassorine, beer, wine, spirits. These are Professor Liebig's general principles of nutrition. The second part of the work consists of details, in which he examines the chemical processes engaged in the production of bile, of urea, uric acid and its compounds, as well as of cerebral and nervous substance. The conclusions to which he has arrived on these subjects are of so great and startling interest, that Dr. Playfair said, he dare not venture to make an abstract of them, without entering into the calculations with which they were accompanied. In the professor's explanatory remarks on digestion, he ascribes a singular function to saliva. This fluid possesses the remarkable property of enclosing air in the shape of froth, in a far higher degree even than soap-suds. This air, by means of the saliva, accompanies the food into the stomach, and there its oxygen enters into combination with the constituents of the food, whilst its nitrogen is again given out through the lungs or skin. The longer digestion continues, the greater is the quantity of saliva, and consequently of air, which enters the stomach. Rumination, in certain graminivorous animals, has plainly for one object a renewed and repeated introduction of oxygen. The professor further touches upon the use of tea and coffee as an article of food. Recent chemical research has proved that the active principles of tea and coffee—viz. theine and caffeine—are absolutely one and the same body, perfectly identical in every respect. The action of tea and coffee on the system must be therefore the same. How is it that the practice of taking them has become necessary to whole nations? Caffeine (theine) is a highly nitrogenized body. Bile, as is well known, contains an essential nitrogenized ingredient—taurine. Now, Professor Liebig considers that caffeine goes to the production of this taurine; and, if an infusion of tea contains only one-tenth of a grain of caffeine, still, if it contribute, in point of fact, to the formation of bile, the action even of such a quantity cannot be looked upon as a nullity. Neither can it be denied, that, in case of using an excess of non-azotised food, or deficiency of motion, which is required to cause the change of matter in the tissues, and thus to yield nitrogenized matter of the bile, that in such a condition the state of health may be benefited by the use of tea or coffee, by which may be furnished the nitrogenized product produced in the healthy state of the body, and essential to the production of an important element of respiration. The American Indian, with his present habits of living solely on flesh, could not with any comfort use tea as an article of food; for his tissues waste with such rapidity, that, on the contrary, he has to take something to retard this waste. And it is worthy of remark, that he has discovered in tobacco smoke a means of retarding the change of matter in the tissues of his body, and thereby of making hunger more endurable. Nor can he withstand the captivation of brandy, which, acting as an element of respiration, puts a stop to the change of matter, by performing the function which properly belongs to the products of the metamorphosed tissues. The third part of Liebig's report treats of the recondite laws of the phenomena of motion; but as it is principally of a speculative character, we pass it over. The professor concludes his valuable communication by two chapters: one on the theory of disease; the other on the theory of respiration. The whole life of animals consists of a conflict between chemical forces and the vital powers. In the normal state of the body of an adult both stand in equilibrium. Every mechanical or chemical agency which disturbs the restoration of this equilibrium is a cause of disease. Disease occurs when the resistance offered by the vital force is weaker than the acting cause of disturbance. Death is that condition in which chemical or mechanical powers gain the ascendency, and all resistance on the part of the vital force ceases. Every abnormal condition of supply or waste may be called disease. It is evident that one and the same cause of disease—that is, of disturbance—will have different effects, according to the period of life. A cause of disease, added to the cause of waste, may in old age annihilate the resistance of the vital powers, or, in other words, occasion death; while, in the adult state, it may produce only a disproportion between supply and waste; and in infancy only an abstract state of health, *i. e.*, an equilibrium between supply and waste. Professor Liebig argues, from what has preceded, that a deficiency of resistance in a living part to the cause of waste is, in fact, a deficiency of resistance to the action of the oxygen of the atmosphere. The professor's theory may be compared to a self-regulating steam-engine. The body, in regard to the production of heat and of force, acts just like one of those machines. With the lowering of the external temperature, the respiration becomes deeper and more frequent; oxygen is supplied in greater quantity, and of greater density; the change of matter is increased, and more food must be supplied, if the temperature of

the body is to remain unchanged. It has been proved, that iron is not necessary to the coloring matter of the blood, but that it forms an essential constituent of blood-globules. These globules, it is well known, take no part in nutrition. Professor Liebig conceives that the iron is the great means of conveying to the lungs the carbonic acid formed in the system; and he has made a calculation, that the iron contained in the body could actually convey twice as much carbonic acid as is expelled daily from the system.

Dr. Playfair, to whom the public is indebted for this able summary, on receiving the thanks of the Section, (also voted to Prof. Liebig,) stated that he had prepared it for a popular assemblage, and referred the more scientific portion of his hearers to the original, for farther information.

REPLICATION TO THE REJOINDER ON THE DOCTRINE OF ROTATIONS.*

To the Editor of the Farmers' Register.

Big Lick, Roanoke, Aug. 17, 1842.

I am truly surprised that you should have evinced so little knowledge of the human heart, and so little regard for editorial popularity, in your note to the last essay of the Rev. Jesse Turner, as to have indulged the Irish hint, that his arguments so fully answered themselves as to render a reply unnecessary. It was, Mr. Editor, a most impolitic and cruel thrust, of a barbed javelin, into the sides of the redoubtable "Le Noir Fainéant," which I am fearful will cool the ardor of his chivalry, and disturb the happy self-complacency with which he has heretofore regarded his prowess and invincibility. To convict *any* dialectician out of his own mouth, by adopting his logic as the very best argument against the truth of his propositions, is distressing and mortifying enough in all conscience; but when you have, as on the present occasion, a special victim, duly prepared for the sacrifice in every particular, even to the garland of flowers, a gentleman of age, experience, and reputation, ambitious of fame as a practical, self-taught farmer, whose knowledge is rather intuitive than inductive, and who, disdaining the aid of philosophers or philosophy, expects to light up the intricate paths of organic chemistry and vegetable physiology by the corruscations of his own genius, you will find the anguish greatly augmented by these adventitious circumstances, and the writhings and contortions of the hapless victim affording indubitable assurance that he is suffering the tortures of being flayed alive. I know full well that the gentleman smarts under your rebuke, and feels that you have at one blow repaid him with liberal interest for all his irony. * * * * * * * * * * * *

With this introduction I would now proceed to vindicate the theory of a rotation in crops, which has been assailed by Mr. Turner, and endeavor to correct the numerous errors and fallacies, which disfigure his otherwise sprightly essay; but really the assault is so feeble, that I see but little to rebuild, while his positions are shifted with so much alertness, and with such pliable consistency, that I am almost deterred from the task of heading and exposing him. I will, however, make a few suggestions by way of reply, lest the gilded speciousness of the gentleman should be mistaken, by careless observers, for the sterling bullion of true knowledge. And first let me ask, how a grave gentleman, who has undertaken to enlighten the community on the subject of agriculture, can be so regardless of the serious responsibilities of his task, as to disparage by sneers the authority of philosophers, who have done more to advance agriculture than all other men living? What shall I say in reply to that part of his essay in which he remarks, "If however, Chaptal, Sir H. Davy, Liebig, &c., can be of any service to him, he may bring *them*. But to the *Frenchmen* I positively object." Thus to strip Chaptal of his birthright as a Frenchman, after a long life of filial devotion to the glory and prosperity of his beloved France, will never do. I am satisfied he would not give up his heritage as a native of *la belle France*, if he were perfectly sure it would advance him in the good opinion of Jesse H. Turner, president of the Agricultural Society of Henrico. This, reader, is one of the important preliminaries insisted upon in this controversy by my authoritative antagonist, who affects great wrath at my intimating a disposition in him to *varnish* his theories with facts, and as it is a precious morceau, we will chew the cud upon it a while longer. As a matter of curiosity and divertisement, let us analyze it. You positively and emphatically object to the authority of *Frenchmen*,

* When a controversy has commenced in a journal like this, and the discussion has become excited, or is beginning to wax warm, the editor is placed in a very difficult position, in which he cannot possibly so act (if aiming to act properly and fairly) as to avoid giving offence to both contending parties. He will, at the same time, offend one by what he admits, and the other by what he rejects, of each of the opponents' pieces. And even if regardless of such offence, and of every consideration but to do what is right, he resolves to prune away all personalities and unpalatable epithets, he will find them so inseparably interwoven with sound and necessary argument, that it is impossible to separate them entirely, and wholly reject the one class, without impairing the force of the other. Under such difficulties we have had already to act in regard to prior controversies which grew out of Mr. Turner's communications, and under such difficulties we have to act now. This discussion, in spite of some previous restraining on our part, (particular and remedial as well as general and preventive,) has assumed a complexion which we much regret—and the more so because of the high respect which we entertain for both the opposing parties, as individuals, and as highly valued contributors to the pages of the Farmers' Register. If Mr. Turner requires it, we must permit him to reply, and thus make even and equal the number of the passes of attack and defence. But with that, this discussion must end in this journal, unless confined strictly to the matter in question, and to principles and things, avoiding altogether what is personal or merely critical of the manner and not the matter of the argument.—Ed. F. R.

as strangers to you, but are perfectly willing to allow the introduction of a *Frenchman*, the celebrated Chaptal, who it is apparent is an utter stranger to you. Surely, Mr. Turner, if you will allow me to change my form of address from the editor to yourself, surely you perpetrated this bull voluntarily, as a modest assurance to me of your Irish descent.

Your next preliminary is equally obnoxious to criticism. You protest against my nice distinctions, and endeavor to avert the force of my arguments by confounding all distinctions. You first introduce a set of technical synonymes, illustrative of your idea, and as a sort of analogical argument, and then complain of my critical distinctions, which are introduced to show that the words used by you, have no such signification as you claim for them. In your first essay of last May, you say that *fertility* is as necessary to one crop as another, that this *fertility*, a term understood by every body, is expressed by different writers by different names. Professor Webster (you think it is) calls it humus, Professor Dana geine, and Liebig ammonia. In reply I pointed out to you the absurdity in which you were involved by this confusion of technical terms. I suggested to you, that the term *fertility* as used by you to express the great desideratum of production *for all crops* could not be synonymous with humus, because there were plants, wheat for instance, which would not thrive in a soil enriched with humus alone. I stated further, that in the pure humus soils of Brazil and in the soils of Europe formed of mouldered wood, (pure humus,) it had been found that the stalks drooped prematurely. That the assigned cause of the failure was, that the strength of the stalk is due to the silicate of potash, and the grain requires the phosphate of magnesia, neither of which substances are afforded by a soil of pure humus. These and other difficulties suggested, you have neither acknowledged nor explained, but content yourself with modestly insisting that I shall abandon all nice and critical distinctions, and allow you to use the words *fertility* and *manure* in your own way.

Having disposed of these preliminaries, the reverend gentleman looses himself from the moorings which he has hugged so closely for nearly two columns, and boldly commits himself to the rocks and waves of an unknown sea. The instinctive law of self-preservation, however, soon comes to his relief, and the flag of distress is unfurled. He protests against being treated as a "long, low, black, rakish, piratical-looking schooner," and denies flatly that he is opposed to every kind of rotation, or even attempted when it was undefended to founder it. But here the gentleman resorts to one of those "*ruses du guerre*," of which he discourses so approvingly. He erects a man of straw that he may display his valor in knocking it down. You totally misapprehend me, Mr. Turner, if you suppose that I for one moment thought you so blinded by your theory as to discard hoed crops as cleansers. That was not the character of my objections, nor does the distinction claimed by you in the present instance, though you are in general a foe to all distinctions, blunt the point or weaken the force of a single argument which I have advanced in support of rotation. As to Mr. Ruffin's views on this point, I leave him to speak for himself. Your position, as defined in the first piece, was that you saw no objection to a succession of the same crops on the same land, provided there was fertility enough to sustain it. That you had no great faith in any rotation from which regular supplies of *manure* were excluded, and that it made little difference what the successive crops were, provided there was a constant supply of enriching materials equal in amount to the crop which was removed. To this I replied, that it was a common observation of farmers in this quarter, that when lands are worn down with long-continued and severe cropping so that their yield in grain is not worth the labor of cultivation, they will produce a luxuriant crop of clover. That not less common is the observation that old tobacco lots, when they grow tired of the crop which they have borne for a long succession of years, and refuse to produce the same heavily, however well cultivated or highly manured, can only be restored as tobacco lots by a rotation. Let us see now how the learned president meets these facts in his rejoinder. He sets out by premising that he "knows a thing or two" of the region where these examples are located; that it is a limestone region of exuberant fertility, to which clover is so natural that he has seen it growing luxuriantly in the woods. He considers clover as more congenial to the Roanoke lands than the grain and tobacco crops, and hence accounts for its vigorous growth on lands which will produce nothing else. But can it be possible that he satisfied himself with an argument so utterly inconclusive and unsatisfactory? The experience of my neighbors, General Watts, Mr. Whitten, Mr. Oliver, and indeed of every observant farmer of my acquaintance, is that old tobacco lots often refuse to produce tobacco, when they are extremely rich and capable of producing heavily, wheat, corn and every thing else except the particular crop of which, in common parlance, "they are said to have become *sick*." Does the gentleman's rejoinder meet these facts? The casual observer must see at once how utterly he fails to resolve the difficulty. It is so glaring that it would be a useless waste of ink to dwell upon it. But the ingenious gentleman is wofully gravelled by another fact given by Liebig, who states that a Göttingen farmer planted all his land in wormwood, and so exhausted the soil of its potash that it refused to produce grass for several years. The gentleman not happening, as in the Roanoke case, "to know a thing or two" of Germany, and the clover theory not fitting, with more boldness than discretion, seizes the bull by the horns, and says that "it proves just nothing at all." But hold, Mr. Turner, not quite so fast. Round assertions and bold assumption, without proofs or arguments, won't do. Grass, you say, is not wormwood, of course it was a change, and you can't conceive why a rotationist should refer to it as authority; nor can you conceive why worm-wood should incapacitate land from bearing grass. If you had read Liebig, whom you so *modestly* deride, with more care, you would have had your difficulties removed, and saved yourself this exposure. He would have taught you that wormwood exhausted the land of potash, which is indispensable to the growth of grass, and you would then have seen that it was a legitimate argument in favor

of a rotation which would thrive on those ingredients of the soil which were not exhausted, till the potash could be restored. But tossed as the redoubtable knight was on the horns of the Göttingen bull, he had hardly regained his feet, when, nothing daunted, he throws down the gauntlet to one of the proscribed Frenchmen. I had stated in my reply, upon the authority of Liebig, that Macaire-Princep had proved by experiment that beans wither in the water in which the same species have grown until the excretions colored it brown, whilst corn plants grow vigorously in the liquid, and the brown color diminishes sensibly with the growth of the plant. I explained it by the fact that beans fed largely on the phosphates, while corn requires scarcely any; and I then ask if it is not clear that at the time the liquid was rendered unfit for the support of beans, it still retained a capacity for producing corn, and that this corn actually fed on the exudations of the beans? And how did you respond? What were the means employed by you to extricate yourself and theory from the dilemma in which you were involved? Let me beg of you, reader, before we advance a step farther, to contemplate for a moment the embarrassing predicament in which the agile Frenchman has placed the Henrico champion. With the Frenchman's small sword run directly through his vitals, and pinned against the wall, he looks for all the world like a preserved subject of entomology—a position which I am sure you will at once admit to be singularly striking and picturesque. In this attitude of constraint and disadvantage it would be unreasonable to expect a very vigorous or efficient defence, or indeed any resistance at all. Instead however of yielding unconditionally, and magnanimously acknowledging himself a dead man, he resorts to another of those "*ruses du guerre*," for which he expresses such unqualified admiration. He sees it is idle to contend against the Frenchman's small sword, and he enters a solemn protest against is use; denounces it as illegitimate, as too slender, too sharp, too elaborately polished, and too difficult to be parried. But to drop the figure, for I can't reconcile it to my feelings of humanity to keep you exposed in your impaled condition, longer than is necessary: to be plain, then, you object to the inference from this experiment of Macaire-Princep, because you class it with those experiments of the learned which you term fooleries! This, it is true, Mr. Turner, would be a very summary and perhaps admissible mode of disposing of the facts, if the blow had been dealt by the giant arm of a Newton, but * * * * The experiments which satisfy the philosophic mind of Macaire-Princep, and which are endorsed by the searching and vigorous intellect of Liebig, and which are concurred in by the scientific world generally, to be unqualifiedly denounced by the Rev. Jesse Turner as fooleries!! Surely, Mr. Turner, you must be a bad illustration of your own theory of the salutary influence of age in begetting caution and *modesty*. Your loose, boyish observation, of the successive crops of cotton in your mammy's cotton patch, behind the kitchen chimney, is to be received as a fact to influence this interesting question, (and I didn't object, as far as it went,) while, forsooth, the labored and carefully digested experiments of the first philosophers of the age are to be decried and cast aside, as the dross of learning and the fooleries of science.

A few more remarks, and I will bring to a close what I have to say by way of replication to Mr. Turner's rejoinder.

Mr. Turner says he has made his strictures upon my reply "with no unkind or *even* indignant feelings," as though he had indulged a most creditable and undeserved forbearance towards me. This claiming credit for not being indignant at my reply, in which I endeavored studiously to avoid every thing calculated to wound, and, to make "assurance doubly sure," appended in a note some very complimentary remarks to him, was the first indication to me of the temper and feelings which had impelled his pen. I had not proceeded much farther, however, before the cloven foot was distinctly visible. Entering the field of conjecture, he says he is not certain, but he suspects I am a *young* man, and makes it the occasion of the following very polite and complimentary reflection: "I like," says he, "to see ardor and boldness in youth, but the gentleman will excuse me for saying that these qualities usually give place, in after age, to *caution* and *modesty*." I am sure my old schoolmates, the Messrs. Selden of Westover and Hanover, whose sensible contributions to agriculture I have the pleasure of reading occasionally, but whose faces I have not seen, but for a moment, in the last twenty-five years, will be greatly surprised to find me metamorphosed into a youth. I am only sorry that the suspicion of the gentleman is not better founded, and that he should have thought it necessary to assume the fact to create the insulting inference of pertness, forwardness and impudence in my assault upon his theory. It was a poor salvo to say that the style of my reply evinced the "scholar and gentleman," when you had discharged upon my head the vials of your wrath and ridicule. After your gratuitous consolation, that I would improve in modesty as I increased in years, you complain of my doing you injustice in several particulars. This complaint, however, being utterly groundless, and adopted by you merely as an apology for your unwarrantable strictures, requires no other reply than the scriptural injunction, that you should take the beam out of you own eye, before you complain of the mote in mine.

W. M. Peyton.

SORREL APPARENTLY NOURISHED BY MARL.

To the Editor of the Farmers' Register.

August 24th, 1842.

My attention has lately been called to a fact, which has surprised me very much, so much indeed as to make me very desirous to hear your opinion on the subject, as well as that of some of your correspondents who have most experience in the use of marl. The fact is this: my nephew, Mr. R. M. T. Hunter, has been marling his land for two years past, to a considerable extent, and nearly all the piles deposited during the winter and spring months were covered by midsummer with a luxuriant growth of sorrel! This has happened both years on each of his two farms, although the field on one of them, upon which the marl was deposited this year, has no

sorrel on the greater part of it, except upon the marl heaps.

The universal opinion, I believe, is that marl will kill sorrel; but here is a fact which has been witnessed by many, that appears directly and undeniably to disprove it. Can it be possible that the same substance can produce and nourish a particular species of plant, the seeds of which must either have been blown upon the mass by the winds, or deposited therein from time immemorial; and yet destroy these plants when ploughed into the earth wherein they previously grew? To me the matter seems altogether incomprehensible. The fact admits of neither doubt nor contradiction—it is absolutely certain; for there were the piles of marl, hundreds of them to be seen for weeks together, covered with luxuriant sorrel, which continued to flourish, until the marl was spread and ploughed in. Do let us hear what you think of this matter; and continue to believe me, yours, very sincerely,

JAMES M. GARNETT.

[As we had given an answer to a similar inquiry formerly, which has been forgotten by our correspondent, and never seen by much the greater number of our present readers, we beg leave to republish it, together with the inquiry and statement of facts which drew it forth.]

Williamsburg, Jan. 15, 1833.

* * * * On a recent visit to my farm, one fact struck me with considerable surprise, as it seemed to be inconsistent with one of your leading principles respecting calcareous manures. The marl which I am now using is very strong, supposed to contain $\frac{75}{100}$ of lime, and is in heaps of from four to five bushels. On these heaps I observed sorrel was growing in bunches of considerable size. Will you have the goodness to account for this fact? It seems to me that I can never get clear of sorrel by the use of marl, since it grows on a marl bed. Your experience, however, may explain this effect, and assist my future use of the manure. * * * * *

Answer by the Editor.

* * * * My own experience, more than ten years ago, furnished me with several opportunities of observing facts similar to those you describe—and, like yourself, I was alarmed at first, at what seemed to be a positive contradiction of my previous opinion, that calcareous manures in sufficient quantity rendered a soil incapable of supporting the growth of sorrel. But further observation served to remove these fears, and even afforded additional proof of the general position before assumed. Where I found sorrel growing on heaps of marl, it was under these circumstances: the loads had been dropped on acid soil (subject to produce sorrel) and had remained without being spread, perhaps twelve months. By carefully removing the marl from the plants, I found that they had sprung, not from the marl, but from the acid soil below—and that the communication between the soil and the air, where the leaves opened, was through a single tap-root, which merely passed through the heap of marl, without drawing any sustenance from it. The plants were usually where the marl was thin, near the edges of the heaps—but one of the roots which I examined was of the remarkable length of nine inches; it had thrown out a few horizontal fibres of about an inch in length, as if in search of nourishment, but which were then (some time in June) quite dead. The few plants then observed, though full of the coverings for seeds, yet were quite destitute of the seeds which should have been within: but this remarkable abortion, though often to be seen under like circumstances, is not general.

Calcareous earth alone is insoluble in water, and can in no way affect growing plants except when mixed with, and acted on by other substances in soils. A load of marl dropped on the surface of the land and left undisturbed, can have no more effect than so much silicious sand, or any other substance of like insolubility, weight and texture, though perfectly worthless and inactive as manure. Marl, if thinly spread, though left on the surface, in the course of time would have all its finer parts carried down into the soil by rains; and thus, ultimately, would act as a manure. But even this slow effect would be prevented by the thickness of a cart load of marl, which would shelter the covered soil from rain, except what it could imbibe slowly by absorption. By thus calling to your mind the existing circumstances, and the insoluble quality of calcareous earth, you will see that in no way could your marl exert its chemical power of neutralizing the acid quality of the soil; by which means only it destroys the growth of sorrel. The germination of the seeds at such depths, and the rising of the plant through such a layer of dead earth, (as marl is in such cases,) proves the remarkable hardiness of sorrel; but its growth in such situations furnishes no proof whatever, that marl when acting as a manure is not destructive of sorrel. To produce this effect, it only requires that a sufficient quantity shall be applied, and equally and thoroughly mixed with the soil by tillage. If plants of sorrel are found on a field that has been sufficiently marled, and the soil well stirred by cultivation, it only proves that from careless spreading, those spots were left without their share of the dressing. But should my reasoning be not entirely satisfactory, you may rely on the testimony of my experience, which pronounces that sorrel will never be found plenty enough to be injurious after even a moderate marling, and that after a proper application, "the soil is found not only cleared of sorrel, but incapable of producing it."

* * * * * * *

Since answering your letter, I have examined many plants of sorrel growing in my heaps of marl which were dropped last year on a poor broom-sedge field. Contrary to my former opinion, I found that the slender horizontal roots stretched through the marl, sometimes eight or ten inches, and were alive early in the spring. But by the middle of June, they were either dying or dead. In one plant only, I found that a horizontal root after passing nearly a foot through the marl, had struck the soil below, and had become nearly as large as the main tap-root. These roots, so long as they are altogether in the marl heap, instead of drawing support for the plant, are themselves sustained by its juices, drawn through the main root from the acid soil. In every case, the only im-

portant fact is uniform—namely, the principal root of the sorrel being fixed in the soil below the heap of marl.

BUFFALO CLOVER.

The following was a postscript to an already published communication from Col. E. T. Tayloe, of King George, and which was laid aside until the information asked for could be obtained. The plant was the indigenous kind called Buffalo clover, which we have seen growing rarely and sparsely on the sandy low-grounds of Appomattox, a little above the falls, and elsewhere on soils of but moderate fertility. The specimen sent was shown to Mr. M. Tuomey, and pronounced to be the *Trifolium reflexum.*—Ed. F. R.

"I send a specimen of clover, of which a luxuriant growth sprung up after a dressing of plaster last spring. What kind is it? If you can do so, describe it in the Register, and give the name. I have seen it in some portions of my farm where red clover has not been sown, but not before in the part where this specimen grew—it dries up much earlier than the red clover, and though the foliage is less, it must be an improver. E. T. T.

THE GENESEE VALLEY.

From the New Genesee Farmer.

The river Genesee rises among the high lands of Pennsylvania, in the neighborhood of the Susquehanna. Winding its way among the mountains it enters New York by the southern side of Allegany county, passes into Livingston county, which it divides longitudinally nearly in the centre, and after traversing the whole breadth of Monroe county pours its rich tribute into Lake Ontario. At its ordinary level it presents an average breadth of only a few rods. Its course is remarkable for its windings and doublings. It has some rapids; and it has at least six considerable falls, all within New York, of remarkable picturesqueness; and at high water of singular beauty and grandeur. Its rapid torrents, its brilliant cascades, its sweeping and in some cases its terrific floods, and its lofty and precipitous walls rising for a considerable length of line to a height of 400 feet, and presenting, in some instances, perpendicular cliffs of 600 feet, are objects of attraction to men of taste, the geologist, and the curious traveller. In these respects they are surpassed in the northern United States only by the world's wonder, the giant of the waters, Niagara.

The river, after successive leaps and rapids, soon after leaving Allegany county, at Mount Morris, becomes a quiet and in low water a sluggish stream, bordering on each side meadows and alluvions of large extent and eminent fertility. At the village of Mount Morris the river may be said to enter the Genesee valley. Here the flats begin, forming an extensive region of alluvial meadow, surrounded by hills of medium elevation and of easy and gradual ascent, presenting an expanse of an average width of more than two miles, as nearly as the eye would enable me to judge. A large portion of this land is cleared and under cultivation. It was to a degree cleared when the whites first came into the country; and was a favorite resort of the Indians, whose judgment directed them to select the most fertile as an instinctive taste led them to spots the most picturesque and beautiful. A considerable portion is still occupied by a deep and dense forest of extraordinary magnificence. The parts which are cleared are adorned, or perhaps it might be properly said left with excellent taste, as they were adorned in their original condition, with here and there a single tree of beautiful proportions, sometimes a belt of considerable length, and at other times a clump equally as grateful in their shades as they are exquisite in their form and foliage. The largest tree that has ever come under my observation, is an oak on the meadow of Mr. Wadsworth in Geneseo, being full eight feet in diameter, standing out in its majesty as the contemporary of other generations and the mute historian of departed centuries. Under its shade the imagination naturally reverted to days gone by and to the changes which have transpired during its long reign. The wild children of the forest, who were accustomed to gather under its spreading branches to celebrate their rude festivities or hold their councils of war, have all departed; and the quiet and rejoicing herds, marking the progress of civilization and humanity, repose securely around it. The council fires are extinguished; the deadly arrow no longer rustles among its boughs; and the war-whoop and shrieks of vengeance, which once filled these valleys with terror, have given place to the songs of harvest-home and the gentle and peaceful undulations of the village bell. Every where among these meadows, clad in a verdure of surpassing depth and richness, and waving with their golden harvests, cultivation has triumphed over the rudeness of nature, and art and skill and taste display their brilliant trophies.

It was once asked, what was the use of rivers, and the reply was, to feed canals with. Acting upon this assumption, the state has penetrated the whole of the Genesee valley, from Rochester to Dansville, with a canal, and availed themselves of the waters of the Genesee river to fill its banks. The line of passenger boats on this avenue are of the best description. The canal from Rochester passes for some distance through an uncleared forest of extraordinary growth, until presently it emerges into a highly fertile and cultivated country, and for its whole distance to Mount Morris, as far as we pursued it, intersected an agricultural country as rich as the eye could rest upon, and dotted all over with flourishing villages and the abodes of rural wealth and independence. Nothing seems wanting to render the picture perfectly enchanting but an expanse of water; and if nature had seen fit to spread out in this valley a lake like that of Canandaigua or Seneca, the imagination would have had no difficulty in recalling all the beauties and splendors of the primeval state.

The soil.—The soil of the country varies somewhat in different places, but is throughout strongly aluminous and calcareous. On the meadows or flats it is alluvial and full of vegetable mould, the washings and gradual deposites of the hills, and so

clayey as to be used with advantage for bricks. In some cases, on the uplands, it is so strongly clayey as to be cold and heavy, and unfavorable to any grain crop and difficult and discouraging in the cultivation. The best soils are undoubtedly those of a gravelly nature, with clay enough to render them tenacious, and full at the same time of small and finely comminuted stones, which are supposed to be limestone, though as well as I could learn no exact chemical analysis has been made in any case. This kind of soil prevails in Wheatland, Caledonia, York and other places, and is eminently productive. On Mr. Wadsworth's farm in Geneseo, I found a marly substance composed of lime and clay, which readily effervesced with acids, indicating the presence of carbonic acid. In the hilly portions of Mount Morris, the crops were later than in the valley region, but promised most abundantly. Here, it was stated to me, no lime is found. These lands, however, have been much more recently brought under cultivation than those which I have before adverted to. The best crop of wheat which I found in my whole journey, though by no means the most extensive, that which promised best in respect to its evenness, cleanness and fulness, was in this part of the country, on the farm of James Conklin of Mount Morris. It was of the red chaff variety. None of these soils as yet, however, exhibit any diminution of their product, though in some cases the cropping is severe and often without manure.

Crops.—The crops cultivated in the county are almost wholly wheat, oats, and grass. Wheat every where predominates, and is the article on which the farmers mainly depend for their cash returns. On the alluvial meadows herds-grass, red top, and various natural grasses prevail: on other lands, subjected oftener to the plough, clover is mainly cultivated.

Of all the crops, wheat claims the principal attention of the farmer. The average crop, as rated almost unanimously by the intelligent farmers whom I consulted, does not exceed twenty bushels, which is certainly very much below what the land is capable of producing. Where the error or deficiency lies, if error or deficiency exist, is not readily perceived; but if possible it is most desirable that it should be ascertained. The quantity per acre of seed sown is about 1¼ or 1½ bushel, and the general practice is to wash in brine, and lime the seed before sowing. The time of sowing is from the first to the 15th September. One or two farmers spoke of the advantage of putting in their seed the last part of August.

Much larger crops are sometimes obtained, and I saw several fields of large extent, which might safely be put down at thirty bushels per acre. Mr. Sheffer, near Scottsville, one of the earliest settlers in the country and the owner of a magnificent farm originally of 700 acres, in Monroe county and intersected by the canal, in the early settlement of the country obtained from forty acres of land in a single field, 2500 bushels of wheat, which was at the rate of 62½ bushels per acre. Within a few years, Mr. Hall, in the centre of Wheatland, on 12 contiguous acres of land, obtained 648 bushels, or 54 bushels per acre. A neighbor of his, Mr. Blackmir, obtained in one case 68 bushels per acre.

Not having had the pleasure of an introduction to either of these farmers, I could not ascertain what particular circumstances of soil or culture enabled them to produce crops so extraordinary. No such results are matter of accident, or, as it is often termed, luck, and must in a great degree depend on some peculiar superiority in the condition, cultivation, or management of the soil. The best cultivation in England and Scotland produces 50 and 60 bushels of wheat to the acre. Now there is no circumstance connected with our climate, soil or condition, which should prevent the wheat farmers in the Genesee valley from producing as much as can be grown by any farmer on any land in the world; and the difference between 20 and 50 and 60 bushels in the produce of a field certainly deserves all consideration. The crops of Wm. Garbut of Wheatland, whose farm, for its condition and crops, strongly attracted my attention, usually average twenty-five bushels per acre. There certainly is no reason why our friends Garbut, or Harmon, two of the best farmers in the country, should allow themselves to be outdone by any farmers in any country.

Mr. Harmon of Wheatland, has taken great pains in the cultivation of wheat, and made experiment with several kinds of wheat, having cultivated them separately with a view to ascertain their comparative times of ripening, their hardiness, their proof against or freedom from injury either by insect, rust or mildew. He is still pursuing these experiments with great care. At the Monroe Agricultural show he exhibited twelve different kinds in grain and in sheaf, with a view to attract the attention of the farmers to this important subject. He has now growing several of the bald and bearded varieties, among which are the Talavera, the Provence, the Virginia May, the red chaff, the Hutchinson, and the Crate, besides others; and of the comparative result he has kindly promised a full account.

He desires me likewise to say, that if farmers will apply to him for seed, they may rely upon that which is clean and genuine. I can have no doubt that this warranty may be entirely relied on.

Oats are here a remarkable crop. I have never seen heavier crops any where. The oat usually cultivated is the common branching oat, and weighs 32 pounds per bushel, and yields ordinarily forty bushels and upwards per acre. I saw one field of the Tartarian or horse mane oat, so called from the panicles hanging all on one side. This I think was at the Shaker settlement in Groveland, and in their cultivation usually yielded from 40 to 60 bushels per acre. The largest growth of the common oat I saw on the rich meadows of Mr. Cuyler, in Leicester; they were nearly five feet high throughout the field. Their yield, though it must be matter of conjecture, would probably not be less than 60 to 80 bushels per acre. But by far the best field of oats which came under my notice, was on the well managed farm of R. Harmon in Wheatland. It was the Scotch potato oat, weighing ordinarily 44 lbs. per bushel, and must yield a very large crop. This oat is said to degenerate after the first year's cultivation. It would be well to inquire what occasions this degeneracy.

The amount of seed sowed is 2¼ bushels per acre. Mr. Harmon informed me that in one instance he obtained 40 bushels from 15 quarts sown. I found some farmers who were accustomed to sow three bushels per acre. The black

oat is sometimes cultivated, but I know no advantage which it has over any other.

Rye appears to be scarcely cultivated here. I saw in my journey only one field. Where as much wheat can be obtained as rye, from the same extent of land and with no greater expense of cultivation, the superior value of the wheat product leaves no ground for hesitation as to which to choose.

Barley.—Of barley I saw many fields, and some very heavy. The average yield stated to me was 28 bushels. Wm. Garbut, of Wheatland, gives me as the average product of his fields, forty bushels. He sows the double in preference to the four rowed barley, and considers one bushel of barley as food for any stock, equivalent to a bushel of corn. Some extensive fields on the Genesee flats must yield more than forty bushels to the acre. The breweries in the country formerly created a large demand for barley, but the progress of temperance has greatly abated this demand.

Peas.—Peas are considerably cultivated, and under successful management yield forty bushels per acre. This, however, is an extraordinary yield. They are mainly cultivated for stock, the grain being quite equal to corn for sheep, and the haum, when well saved, is as nutritious and as much relished as any long feed which can be given them. A pea called the grass pea I found growing in two instances, in the one for the use of bees, for which purpose it was sown broadcast and much esteemed; in the other, as matter of experiment, in order to ascertain its yield and its value. It did not promise much.

Indian corn.—This may be considered as a rare crop in the Genesee valley, and the cultivation of it inferior. Mr. Wadsworth gave it as his opinion that the average yield was not over 25 bushels per acre; but Mr. Bond, an experienced and intelligent farmer, stated that with good cultivation fifty and seventy-five bushels per acre might be had, and he had himself known instances of 116 bushels per acre. Indian corn is evidently not a favorite, and is fairly distanced by its great competitor, wheat. There may, in the condition of the market and various local circumstances, be good reasons for this; but when the value of the grain and the value of an acre of well-cured corn fodder are both considered, when sheep, or horses, or horned cattle are kept, I believe that the corn crop deserves much more attention than it receives.

I was surprised at the statement of Mr. Brooks of Brooksgrove in Mount Morris, that corn, to use his own expression, will not grow there upon newly cleared land, even when it has been burnt over; and that the land must be sometimes under cultivation before a crop of corn can be produced. This is contrary to almost universal experience in other places, where newly cleared and burnt land is considered highly favorable to corn. I am at a loss to account for this, but I cannot demur to so high authority. Large crops of wheat are obtained here. The growth is principally oak on the high lands, with some sprinkling of hickory; on the lower and moist lands we find much rock maple and elm.

Potatoes are not largely cultivated. They are valuable for seep; but the present prices of pork and beef give no encouragement to their cultivation for swine or cattle. That potatoes are much more valuable for sheep and cattle than ruta baga, I have no doubt; but as many bushels are not usually obtained on the same extent of land; and the care of preserving and the cost of seed, and the labor of harvesting favor strongly the cultivation of ruta baga in preference.

Esculent vegetables—In so hasty an excursion through the country and so superficial a view as was in my power, it would be presumptuous in me to speak with confidence on any subject connected with the husbandry of the country, or think to afford much knowledge in relation to it. I can only say that I saw but a single instance of the cultivation of esculent vegetables for stock. This was on the farm of Mr. Garbut in Wheatland, who had several acres in carrots, beets and mangel wurtzel. I must leave it to some other occasion to discuss the pros and cons in relation to this matter.

Of *flax*, I saw only one field, and that at the Shaker village in Groveland. It appeared well. The habits of this industrious people, who, as a general rule and as far as it can be done, produce and manufacture all their own clothing, lead them to the cultivation of flax, which is in a great measure abandoned by other farmers. This crop I am persuaded might be cultivated to advantage by many farmers. Where 300 lbs. of lint and fourteen bushels of seed can be obtained to an acre, and this is not uncommon under good cultivation, the crop will yield an ample compensation for its expense.

FOREST TREES.

From the Cultivator.

It must be a subject of astonishment, to observe the wonderful intermixture and seemingly inseparable connexion between both moral and physical good and evil—to see that the same thing which we at one time dread with abhorrence, at another time, and perhaps under a little different circumstances, becomes a subject of pleasing admiration. We often hear heart-rending tales of the gloomy and dismal forest, and yet to a person of good taste, there are no charms in the compass of nature's works, surpassing those of the forest.

The emigrant to a unsettled country, looks upon the trees as so many savage enemies, which he must conquer and exterminate before he can hope for the enjoyment of peace and tranquillity. When other emigrants settle around him, and they begin to direct their united efforts towards arriving at a state of civilization, they see nothing in their mind's eye, but cultivated fields, with meadows and pastures, with all the stumps eradicated, and not a single cluster of trees to interrupt the view. If a single patch is left for firewood, it is often sneered at, as it is cheaper to buy wood than to devote the ground to its incumbrance.

But the population increases, perhaps becomes a city. The demand for firewood increases, and timber is wanted in all the various departments of ship and house building, and every patch of forest vanishes before the footsteps of cultivation, like patches of snow before the vernal sunshine, until, as is the case in some countries in Europe, and even in some parts of this country, every piece of timber has to be brought from great distance, if not even imported from a foreign country, and coal dug from the earth for fuel.

In this state things, sober reflection, which though a slow, is often a correct teacher, shows us by costly lessons what it would have taught before, had it been consulted, that if, instead of wastefully destroying and exterminating the forest trees, they had been used with prudent economy, when necessary, and skillfully managed and preserved when not, they might have contributed largely to pleasure and to profit. The same follies have been extensively committed by other nations; but they have long since discovered their error, and are in many instances setting us examples, worthy of imitation, in retrieving it. If we profit by their example, it is still in season to avoid the error in many parts of our extensive dominions, and where it has been already committed, we can by a judicious course do much towards making amends in our own days, and avoid entailing on posterity a vast amount of unnecessary trouble and expense.* The clearing of a country of forest trees produces, no doubt, atmospheric and meteorological changes more or less connected with health; but we choose to leave that part of the subject to those who are professionally the guardians of health, and to speak of it only as it relates to the common comforts and conveniences of life.

The use of forest trees to which we refer, are for shade, for fuel, for timber, and for protection against wind.

Of shade trees, both for timber and ornament, we have indigenous a greater variety than any other nation. It would be useless to attempt forming a catalogue, but a few may be worthy of particular notice.

As an ornamental tree, the sugar maple—*Acer saccarinum*—for avenues or the streets of towns, stands unrivalled; the wood, valuable in the arts; maple orchards a profitable investment.

Yellow locust—*Robinia pseud acacia*—a most valuable timber, much in demand for mill cogs, ship trunnels, fence posts, etc.

Shellbark hickory—*Juglans regia*—ranks with the first class of our forest trees; timber of great strength and elasticity; wood, as an article of fuel, unsurpassed; produces delicious nuts; the trees worthy of cultivation for their fruit alone; the nuts may be increased to twice their usual size by cultivation.

White oak—*Quercus alba*—timber in high repute; accommodates itself to almost any soil.

Chestnut—*Castanea*—attains a large size, prolific in valuable sweet nuts, susceptible of great improvement.

White elm—*Ulmus americana*—a general favorite, often reaching an altitude of 80 to 100 feet. feet.

Black larch—*L. pendula*—for timber or picturesque effect, worthy of cultivation. The tree much neglected.

White ash—*Fraxinus americana*—the wood in great demand for farm implements, by the wheelwright and carriage maker. The pines and firs add much to the beauty of home, and for bleak and exposed situations form a good shelter. The balm of Gilead fir—*A. balsamea*—a beautiful evergreen; and the white pine—*P. strabus*—the king of its genus; its beautiful stately form will add much to rural embellishment.

A stranger travelling through almost any part of the United States, would think he had met with the strangest anomaly ever presented. He would have heard, no doubt, that the Americans were a people of refined taste, awake to all the beauties, not only of nature, but of poetry and romance; and yet, perhaps, in a day's ride, passing the dwellings of the rich and poor, he would scarcely see a tree connected with a house for beauty or for shade, much less the rich and elegant groups of trees he would have anticipated finding. To such a traveller from almost any other civilized country, to see a decent country house standing like a hay stack in a meadow, the conclusion would be that its inhabitants, whatever fame might have reported of them to the contrary, were as destitute of taste as those animals of the meadow that fed upon the hay stack.

There is nothing in the compass of inanimate nature so interesting as trees. They speak a language to the heart which none but a heart of utter insensibility can fail to understand. They awaken to recollection the memory of scenes long past, not only in the innocent sports of childhood, but often those of deeper interest. It must be noticed by every observer, that even the brute creation feel a veneration for trees. A tree is a house, furniture; it may be made clothing and even bread: "It forms part of almost every implement and every machine by which the genius of man has taught him to lighten the labor of his hand. There is that in a tree, considered as an individual work of the Creator, which may well excite our attention, and most amply reward our study."

For fuel, and more especially for timber, economy alone, without the aid of good taste, would, if consulted, be sufficient to plead for the preservation of forest trees.

But when the folly has been committed, and its consequences are beginning to be sensibly felt, what remedy can be applied, if not to afford immediate relief, at least to prevent posterity from suffering by its effects? The still small voice of common sense, confirmed by the examples of several nations of Europe, points to the remedy. The first step is to establish nurseries, where all the most valuable trees could be obtained at moderate prices; a few would avail themselves of their advantages, and the force of example would soon excite the multitude to follow them, and in a few years, those who lived to see our dwellings, which now stand as unornamented as milestones, tastefully surrounded by beautiful trees, and their value doubled in the eye of most purchasers; they would see our public roads lined with extensive rows of valuable trees, and last, though not least, our farm houses would be sheltered in their situation from bleak and destructive winds by belts of the pine and fir trees, and their cattle and sheep would find protection in winter, and places of repose from the sultry summer heat.

MAGNOLIA.

* Massachusetts is doing her duty. Among her state premiums is noticed one for the most extensive forest of any sort of trees suitable for timber, raised from the seed, not less than 1000 trees to the acre, which shall be in the most flourishing condition, and more than five years old in September, 1845, $50.

Another premium of forty dollars for the best plantation of oak or other forest trees, suitable for ship timber, not less than 1000 trees per acre, to be raised from the seed, which shall be in the most thriving condition, and more than three years old in September, 1847.

REPORT TO THE N. JERSEY AGRICULTURAL SOCIETY, ON RUST AND MILDEW.

From the American Farmer.

The regular quarterly meeting of this society was held in Princeton, on the 23d ult., the president, *Caleb Smith Green*, in the chair. The president reported that both the trials made by Capt. Lavender and himself, to germinate the grass seed from Peru, had failed of success.

Mr. Green, from the committee appointed to investigate the cause of, and to report the best *preventives* against rust and mildew of wheat—read the following report on that important subject, which was ordered to be filed and published.

Mr. President.—Your committee, in their endeavor to investigate the subject of mildew and rust on wheat, and what may be in some measure preventives, will first present to your consideration some circumstances which have occurred under our observation, to show that it is not in the power of us short-sighted mortals, with our puny arm, to contend against the overruling providence of God: occurrences arise which are not in the power of man to foresee, govern or control. In confirmation of this view of the subject we present the following cases.

One of our farmers had an extraordinary piece of wheat, which he thought out of danger, it was so near ripe. On a very hot day, between the hours of one and three o'clock there came a small cloud over, which completely drenched the field of wheat. A deathlike stillness succeeded; the cloud passed away; the sun shone intensely hot. The owner in this state of the case, went to examine the wheat, as it was much pressed down by the shower; he immediately observed a continual ticking, or snapping noise in every direction in the wheat. The straw was fine and bright, but upon examination he perceived it bursting in short slits of a fourth of an inch long, and the sap exuding in thousands of places. A day or two after, the whole field was darkened with rust and the wheat of very little value. It does not appear that these circumstances take place while the wheat is growing, but only at this critical state of ripening.

On my neighbor White's farm some years since was one of the heaviest pieces of wheat straw I ever saw, remarkably fine, and nearly ripe. I had also a good piece advancing fast to maturity; on a close warm morning, a small cloud of fog arose from the meadow and gradually covered the two fields, but was not a general fog; being very still it remained hovering over the fields until the hot sun dissipated the vapor. Being acquainted with the above case, I was alarmed for the wheat and watched over it with deep interest. When the sun had somewhat dried the straw, and warmed it, the straw began to burst with a continual ticking noise, the sap exuding at all these little splits. In a day or two the fields were black with rust, except some small spots, which are worthy of notice. An acre or two of mine was so near ripe that the wheat was tolerable good, and the rust on this part of a reddish brown. In Mr. White's field there were some trees which kept the intense heat of the sun from the straw: there was tolerable wheat, also. The rest of the fields would scarcely pay for gathering and thrashing.

A question of importance arises on these two cases. Was this injury a fungus, the very fine seeds of which float about and attach themselves to the straw, as some of our learned agricultural writers tell us, or is it the sap of the straw that ran out and was dried on the straw, and was reddish or black according to its state of ripeness or fulness of sap?

Your committee are decidedly of the opinion that the sap being lost at this critical time of ripening is the true cause of the shrinking of the grain.

Some of our most judicious agricultural writers have taught us that the leaves of Indian corn above the ear cannot be taken off at the time of ripening without detriment to the corn, causing it to shrink in the grain.

Your committee made an experiment on this case, when the corn was nearly ripe, stripping some rows, and leaving others, over several acres. At husking time it was evident that on the rows that were stripped, many of the ears were considerably shrunk in the grain, so much so as to be loose on the cob; the ears on the rows that were not stripped showed none of those shrivelled grains, thus showing in the most satisfactory manner the damage sustained by removing the leaves above the ears.

Your committee think they are fully sustained in their conclusion on the wheat, by the parallel case of injury sustained by the corn in the removal of the leaves, which at this critical time has the only nourishment to sustain the corn in ripening. So of the wheat straw; the bottom is dead in a great degree, but from the upper joint to the ear is full of nourishment to sustain the wheat in ripening, and this is the part that suffers the loss of sap. The under part of the straw is ripe, and passed through the state in which it can suffer loss, and we often find it bright and tough at the bottom, when the top will scarcely make a band.

These two cases fully demonstrate the impossibility of any management in the power of man, always to insure a crop of wheat safe against the destructive effects of rust. Yet a kind Providence has left us so many means by which we may reduce loss, and in some measure approach to this very desirable security, that they are worthy of our attentive consideration, and practical experiment.

Mildew and rust, are more common now, than before that destructive scourge, the Hessian fly, appeared in this state. Previous to that time the wheat was sown the last of August, and the first of September, tilled largely, obtained great strength of roots, and was but little injured by winter frosts; the effect of which was to produce strong bright straw, with but few leaves, the consequence of which but little mildew and rust.

The fly having totally cut off the wheat, put the farmers on many schemes to meet this ruinous enemy. Among the experiments tried, manuring high just at seed time, and sowing late, was much depended on. But disappointment frequently followed from mildew or rust. As the wheat was often sown late in October it ought to have had three bushels of seed to the acre, instead of three pecks, or one bushel, the usual quantity then sown. Being sown so late, the plants had no time to tiller, or multiply and strengthen their roots and stalks; of course the winter weakened and thinned the plants, which made the wheat still later in the season and when highly manured the straw

was full of leaves, very succulent, usually mildewed, and almost certainly rusted—of course, a crop of small value.

At this difficult time of obtaining a small lot of wheat, one of your committee, in a conversation with an Englishman who then was a very successful raiser of wheat on Penn's Manor, fully stated the difficulties as above narrated. He considerately replied, that there appeared to be two prominent errors in the then practice—the manuring so late, and sowing so little seed.

Ques. What injury by late manuring?

Ans. Apt to make the straw very succulent and full of leaves.

Ques. What quantity of seed ought to be sown?

Ans. Increase the quantity till it fully occupies the ground, making the straw fine and but few leaves.

This short history of the difficulties, and means made use of to obtain a small lot of wheat immediately after the fly came, your committee thought might be of use in further examining the subject. It shows the progress we have made at the present time in better cultivation, earlier manuring, earlier sowing, and doubling the quantity of seed sown.

First means—The means of prevention—first a good dry, loamy soil, well prepared by cultivation, not too recently manured, that by cultivation there may be a good assimilation of manure to soil, the more complete the better. Cover the seed about two inches deep, either with drill or plough, that it may have a good hold of the soil, and not be thrown out by winter frosts.

Second means.--Quantity of seed sown must depend on the judgment of the farmer. The strength of the soil, the size of the grains, &c., must be taken into consideration. The grains of some wheat are almost as long again as some others, and some kinds tiller more than others; at any rate let the ground be fully occupied that no weeds or trash occupy the ground and fill the void spaces between the wheat, or thin places, which will be full of leaves and sap, and of course, rust. Such thin places, by unequal sowing, were observable in some fields this year, by their dingy or rusty appearance; whereas, the rest of the land sown was bright and good.

Time of sowing—As early sown wheat produces the strongest straw and fewest leaves, and not so liable to be laid with wet, nor so apt to be thrown out of the ground by winter frosts, these reasons recommend it as a preventive to rust.

At what particular time wheat ought to be sown to escape both fly and rust is not easy to settle, but should the fly cease its depredations, early in Sept., say from the 18th to the 20th, would be advisible, for the various reasons assigned above. The late sown wheat sometimes succeeds under particular cultivation and soil; still the chances against it are as ten to one.

Kind of wheat.--In a former communication your committee recommended the Mediterranean wheat as most safe. Hitherto the fly has not touched it. It has the same character at the south, as we see by the Farmer's Register,—being untouched there. This is strongly in its favor. It is also less liable to rust* than any kind we are acquainted with. But other kinds may offer, and upon trial be found preferable to the Mediterranean. The Goldenrock, now upon trial, may offer some advantages. It has a strong, short straw, not liable to get down by wet as some other kinds, and said to be of excellent quality for flouring.

Means of improvement.—We see abroad in the land and around us, among the farmers, a more certain means of improvement than any thing your committee can offer. A spirit of inquiry; a wakeful ambition to meet the difficulties of their profession; a desire to obtain the best seeds, to produce the best quality and greatest quantity of their various products; this, my friends, is the surest foundation of all permanent improvement. These hitherto dormant faculties, if kept aroused and active, will produce results in ten years from this time, that will surprise us all, for we are well persuaded that New Jersey is capable of producing fourfold what the land now produces.

* This season the Mediterranean wheat has rusted in some fields and in some spots in others; in my own field, the cold, damp, and thin spots, were somewhat rusty; upon the whole a good crop, and quite as free from rust as the white wheat.

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THE FARMERS' REGISTER.

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EDMUND RUFFIN, EDITOR AND PROPRIETOR.

AGRICULTURAL EXCURSION IN THE GENESEE VALLEY CONTINUED.

From the New Genesee Farmer.

Buckwheat is raised to some extent, but not largely. I could not learn that in any case it had been used as a green-dressing to be ploughed in, a process not unknown in some parts of the country, and from which I believe much benefit may be derived. The cost of the seed is a small affair; and preference of such management over a naked fallow can hardly admit of a doubt. A few careful experiments in this case would decide an important question.

Grasses.—The grasses cultivated are the red-clover and timothy or herds-grass. The meadows or alluvions on the Genesee river abound in rich natural grasses, and are peculiarly favorable to the growth of grass.

In one or two cases, on a small scale, I found the orchard grass cultivated; but merely as an experiment; and I met with two small fields or rather patches of millet, sown probably for the same reason. The stalk was extremely large, which indicated, in my opinion, too thin sowing; certainly, if it were intended that it should be cut for hay. This is a common error. The allowance, with most farmers, of seed for a crop of millet is one peck per acre. If the land is rich, the stalk in such case becomes as large as brush; but where a bushel is sown to an acre, the stalk is small and fine, and the hay, when well cured, of the very best description. I have myself obtained three tons to an acre, weighed, after being well cured, at the public scale.

Of grasses, clover is extensively cultivated. It is sown on the wheat in the spring at the rate of 7 or 8 pounds to the acre. It is commonly depastured in the fall, and the field is allowed to continue in clover the ensuing year, and the succeeding spring is ploughed and fallowed for wheat. In other cases it is depastured in the fall of the year in which it is sown; and in the ensuing spring the land is ploughed and fallowed for wheat.

There may be said to be three distinct kinds of clover customarily sowed by the farmers; the first is the June or southern clover; this is comparatively small and ripens early, the next is the northern or Vermont clover, which ripens late and grows with great luxuriance; the third is the Ohio clover, which holds a medium character between the two. I found that both for hay or for ploughing in with the stubble, farmers differed in their choice, preferring either the southern or the Ohio clover. The southern clover makes the best hay and is more easily cured than either of the others. The northern clover makes a very coarse hay.

The crop in general averages from two to three tons. The opinion of many of the best practical farmers, whom I consulted, is decidedly in favor of curing it mainly by sweltering in the cock. In this case it is cut but not spread, and after lying in swath until it becomes entirely dry from extraneous wet and slightly wilted, it is put into small cocks and suffered so to remain until it becomes *made*, which can only be determined by good judgment and experience. The cocks are then turned directly upside down, until the dampness gathered at the bottom of the cock is wholly dried off, and are then carried into the barn. I have known this same method practised by some of the best farmers in Massachusetts, and in other parts of New York; and the hay under such circumstances retains its sweetness and color, the flowers and leaves are not shaken off and lost, as when the grass is much tossed about and spread; and the hay proves of an excellent quality.

Timothy or herds-grass cannot be said to be cultivated extensively, though I think some of the finest fields of herds-grass which I have ever seen, I found on Mr. Le Roy's place near Avon, on the opposite side of the river. I hardly know what could be more luxuriant, even and beautiful. On the Genesee flats above in the great valley, the hay was most abundant, but, as I have remarked, of a more mixed character. Mr. Wadsworth is accustomed to feed or depasture some of his fields so late in the spring that the crop of grass is not fit to be cut until the season is far advanced. This divides and extends his time of haying, as the different fields ripen in succession, and his haying season reaches into September. This late-grown hay is, I presume, not so substantial and nutritious as an earlier crop would be, partaking very much of the character of rowen, but this is compensated by the advantages of the feed in the spring. The practice of taking two crops does not, that I could learn, prevail here: and this I believe from an oppressive feeling of abundance rather than that it might not in many cases be done to advantage, for with respect to many of the farmers of this rich section of country, the case must be as with a farmer mentioned in another place, who needed to pull down his barns and build greater, that he might have where to bestow all his goods.

It is difficult to estimate with any great exactness the ordinary yield of these best lands in grass, but it may be safely put down as averaging over two tons per acre. I do not know where finer crops are to be found, and this would be an under estimate of some fields which I went into.

Hay is, in many cases, stacked, sometimes near the barns and at other times in the fields. I saw but few instances in which these stacks were thatched; but in many the stacks were put up with extraordinary skill and care, and so were pretty thoroughly protected against the weather. Mr. Wadsworth has, scattered over his fields and meadows, a great many small barns in which the hay is stored; and at which places his cattle and sheep are fed in the winter, but not housed.

The proper stacking of hay is quite an art, which an Englishman or Scotchman understands well; and if allowed to take his own way will perform with so much skill, I may add, taste, that I have often admired these stacks for their effectual protection of the hay, when well thatched,

and for their beauty as picturesque objects in a rural landscape. But it is an art of which in general a Yankee knows nothing, and in which he is commonly a sad bungler; and this not from any want of capacity, but from a deficiency of patience, owing to the driving haste with which most things are carried on among us; and from a habit, but too common, of only half doing most things which we undertake.

Of *stock* in the Genesee valley and its vicinity, I can judge but very imperfectly. It is hardly to be considered at present as a stock-raising district, the land being chiefly devoted to the growing of wheat and grass. Mr. Wadsworth feeds large numbers of cattle upon his meadows, but many of these are purchased and not bred by him. He has bred, however, some improved stock, and has several animals of full and mixed blood. Mr. Le Roy and Mr. Newbold, in York, have a considerable herd of improved animals of a high character. I saw them merely in passing, and regretted that I could not go among them; but they are held in high estimation in the opinion of competent judges.

I scarcely found a farm where any considerable number of cows were kept for dairy purposes beyond the use of the family. The cows met with in general were of no particular breed; and were, as far as I observed, in good condition. Perhaps I should except from this eulogium the cows which go in the highway, a race which, in Ireland, are so much valued for their skill in leaping hedges and ditches; and at sales are always commended for their capacity of "getting their own living." I could get no exact account of any dairy product. The average yield of a good cow in new milk cheese was stated at about 300 lbs., and where her milk was devoted exclusively to butter, at 110 to 150 lbs. per annum. These statements, however, were rather conjectural than ascertained; but to all inquiries respecting the yield of their cows in milk, the stereotyped answer was always made, that they gave a *pailful* at a milking; an answer which I have always admired for its precision, especially as pails are all of one size!

The general impression among the farmers in this part of the country seemed to be, that while the improved Durham stock was decidedly to be preferred for its beauty, size and thrift, yet for milk they were considered inferior to the best selected cows of our native stock. The first crosses have almost always proved well. How far this impression or opinion is to be valued must depend on many circumstances. It may be mere prejudice or an opinion taken up at hap-hazard; and but very few persons, if any, in this part of the country have had that long and careful experience with the race, that would justify them in coming to so great a conclusion. The truth is, with a few exceptions, we in fact know little of this stock at present; and the haste with which some men approve or condemn, is well illustrated within my own experience, where, for example, an individual farmer of no mean judgment undertook to give their character with perfect decision, whose whole knowledge of them extended to the owning of a half-blood two years old bull for a few months.

If any man, however, chooses to see this stock in perfection, let him go to the farm of E. P. Prentice of Albany; and if he has any prejudices of any kind against the stock, and is not then prepared to yield every one of them, I can only say he is differently constituted from what I am. Mr. Prentice has about forty animals of the improved Durham short horn, of pure blood and of the highest pedigree. He has one cow with seven heifers of her own progeny along side of her, six of which were in milk. A stock of larger size, of more symmetrical form, of equal beauty, of finer feel, of more thrift, of greater productiveness, I never have seen and never expect to see; nor do I expect to see a herd better kept, nor better arrangements for their keeping. To an amateur, to an inquisitive farmer, who desires to see what skill, intelligence and care can effect in moulding and improving the animal frame, it is worth a journey from Rochester to Albany on foot to see this stock. It is worth almost as much to see Mr. Prentice's stable arrangements and the tidy manner in which every thing is kept. Some few farmers among my acquaintance, in going there, would hardly know that they were not in their own best parlors. This, however, seems to convey a slight reflection upon some farmers' wives; but that is not my intention; and, as I would not upon any account be disrespectful towards the ladies, I beg my readers to draw black lines around this paragrapth and consider it as "expunged."

I have only to desire that Mr. Prentice would by a lactometer ascertain the qualities of his milk; and then that he would ascertain the actual yield in butter of several of his animals for a week or so; and when this is done, that he would show his benevolent countenance in the New Genesee Farmer, and let our readers know all about it. Our friend Tucker, of the Cultivator, has too much generosity to complain of this; or to think we have jumped over the fence into his pasture, with a view to catch and bridle one of his best colts. He has a full team always in his own stables.

The farm work in this part of the state is performed almost exclusively by horses. The horses in general are horses of all work. No horses among us are raised for the turf, and the various vehicles in use, wagons, dearborns, buggies, sulkies, &c., have put saddles almost wholly out of use. This is to be regretted, for there is no more manly, healthy, and vigorous exercise, for man or woman, than riding on horseback. The horses in general are of a medium size, and impressed me favorably.

Of the comparative expediency of keeping horses rather than oxen, or otherwise, I shall not speak in this place. Confidently as some persons have decided in this case for themselves, there are yet two sides to the question. A pair of horses is required on almost every farm for market, church, visiting and business from home; but if the team must be extended beyond this, it is well worth considering whether oxen may not be kept to more advantage than horses. We shall now give no opinion in the case, but suggest it for farther inquiry.

Of *sheep* I saw some flocks, but not many large ones. Mr. Wadsworth has several thousand; the Shakers at Groveland have a considerable flock; Theron Brown of Wheatland, has a flock of 500 sheep of mixed blood. His wool brought

this year 28 cents per lb., last year 35 cents.; the previous year 44 cents. The average yield of this flock, where there was a large proportion of wethers, was 3 lbs. 4 oz. of washed wool to each sheep.

In his opinion, 7 sheep require a ton of hay for wintering. Hay is valued at 5 dollars per ton. The annual increase of the flock is reckoned at 25 per cent. The value of mutton here is very little, and that increase will do little more than keep the flock good. Giving, however, the flock the advantage of all the increase, the account may be thus stated:

Wool, 3¼ lbs. at 28 cents	91 cents.
Lamb, 1 in 4 or 1-4th,	25 "
	116
Keeping 1-7 of 500,	71 cents.
Pasturage, say	40 "
	111

Net balance in favor of sheep, 5 cents.

This presents no great encouragement to the sheep husbandry. Mr. Brown is of opinion that swine and cattle are not worth raising beyond the wants of the family. I give it as the opinion expressed by him and some other farmers to me, but as a matter in my own judgment admitting of several qualifications. It is a complex question, in which a good many elements are involved, and my very imperfect knowledge in this case does not authorize me to pronounce with decision.

The value of land is rated here at 50 dollars per acre. The yield of hay estimated at 1½ tons. The hay at the above estimate would be equal to $7,50, and the expense of getting can hardly be less than $2,50 per acre, leaving 5 dollars income in favor of the land. But on a farm it must be considered that there is much land in wood or in fallow, or otherwise unproductive; and there are uncertainties attending all crops and seasons.

FARMING OF MR. WILLIAM WEAVER, OF ROCKBRIDGE COUNTY, VIRGINIA.

To the Editor of the Farmers' Register.

Mr. William Weaver, a wealthy iron-master of this county, and one of the most judicious practical farmers I have ever known, has, for several years past, been cultivating a portion of his extensive estate with distinguished success, upon a system entirely novel in this section of country, the Valley of Virginia, a brief outline of which may not be unacceptable to some of your readers.

The traveller from Lynchburg to Lexington, up the picturesque and romantic valleys of the James and North rivers, cannot fail, if he will but lift up his eyes as he approaches the mouth of Buffalo, about nine miles from the latter place, to observe, at the distance of two or three miles up the river, a cluster of precipitous hills—the outposts, as it were, of the Blue Ridge—proudly rearing their green and rounded summits above the adjacent valley, and apparently covered to their very tops, by the hand of man, with the richest and most luxuriant vegetation. These steep and rough hills, most appropriately designated by Mr. Weaver as the "*Highland Farm*," against which the North river dashes its foaming torrent, which slope in every direction from their summits to their base, presenting angles of from twenty to fifty degrees, constitute the land in question.

About ten or twelve years ago, Mr. Weaver purchased this farm, now embracing upwards of 800 acres, in several distinct tracts, at an average price of $2 an acre, principally for the purpose of procuring the wood, with which it was then covered, with the exception of about 100 acres of cleared and exhausted land, to supply his iron establishment with coal. The native growth consisted of oak, hickory and dogwood, with large pines interspersed. The soil is a red gravel, strongly dashed with slate, reposing on a limestone foundation. So unpromising an appearance did this land present for agricultural purposes, that when Mr. Weaver told his neighbors he intended to make a corn farm of these poor and steep hills, a laugh of derision was the only encouragement he received.

As the clearing progressed, Mr. Weaver divided the cleared land into four fields, one of 100 acres for standing pasture, and three of about 120 acres each for cultivation. The first field of new ground was broken up, early in the spring, with McCormick ploughs, drawn by two mules each, and cultivated in corn. The crop did not exceed an average of twenty bushels to the acre. In the fall the field was seeded in wheat, upon which, late in the winter, the usual quantity of clover seed, and half a bushel of plaster, were sown to the acre. After the wheat was removed at harvest, the stubble was gleaned by the stock of hogs. Very early next spring an additional half bushel of plaster was sown to the acre over the whole field. During the spring, summer and fall, not a single animal of any kind whatever was permitted to invade the clover field, nor was any clover cut, except a very small quantity on the most luxuriant spots, for the use of the mules while at work on the farm. The next winter, however, the stock of hogs was kept in the field, which was ploughed up early in the spring, and again planted in corn. In the fall it was seeded with wheat, and in the winter sown with clover and plaster. The other fields, as they came successively in cultivation, were treated precisely in the same manner, with the exception of the standing pasture, which has never been ploughed up since the first course of crops, and of the hundred acres of exhausted land, above spoken of, which, being too poor to produce corn, was sown first with oats, and then with rye, clover and plaster, when it took its course in the regular rotation.

Now mark the result of this system of cultivation. The crops of corn on these poor hills have for several years past averaged about forty bushels to the acre, while this year's crop, on a field of 130 acres, is pronounced by competent judges to be the best in the county, on either bottom or upland. The entire field, it is supposed, will average upward of 40 bushels to the acre, while many contiguous acres can be found which will yield at least 60 bushels. I have heard some of the most intelligent neighbors express the opinion, that it was the best field of corn they ever saw. The crops of wheat succeeding corn, though improving every year with the progressive improve-

ment of the land, have never been heavy. The average may probably be set down at from eight to fifteen bushels, the crops having been of late years very materially injured by rust. Mr. Weaver's object is corn, of which immense quantities are consumed by his iron establishment. Were wheat his staple crop, he would sow it upon a clover ley.

Mr. Weaver informs me that clover did not succeed well on his new ground until it had been well cleansed by his second course of crops. It is now generally very heavy. His fields were at first much infested with sorrel, which has at length been almost entirely extirpated. Mr. Weaver regards it as all-important to the success of his clover, that it should be plastered, at the rate of half a bushel to the acre, about the time of sowing the seed. He sometimes even strews plaster on his wheat in December or January, previously to sowing his clover seed. He attributes the rapid improvement of his soil to the shelter afforded to his land by the thick growth of standing clover, as well as to the heavy coat of vegetable matter which it enables him to plough under. If clover is sown for the improvement of the soil, he regards it as a great error to graze it at all. He contends that his standing pastures, which in a few years are covered with white clover and green-sward, yield him more and better pasturage for his cattle than his clover fields would afford. Consequently he never ploughs them up.

No lime has ever been applied to this land, nor any manure, except a few loads annually from the mule stable to the poorest spots. The improvement has been effected exclusively by the use of clover and plaster. The land, as steep as it is, does not wash—a result which Mr. Weaver attributes to his deep ploughing, and to the large quantity of long vegetable matter the soil contains, which binds it together, and at the same time keeps it loose and porous, enabling it to absorb and retain a large quantity of water.

Mr. Weaver lays great stress on applying plaster to his clover fields, either in the winter, or very early in the spring, that it may be thoroughly dissolved by the early rains. He attributes much of the benefit he has derived from the use of plaster to his practice in this respect, in which he says he is sustained by Prof. Liebig. Plaster, it is well known, absorbs a large quantity of water, and does not operate on growing plants until it is dissolved.

Mr. Weaver's mode of cultivating corn is as follows: In the month of December he sows one bushel of plaster per acre upon his clover field designed the next year for corn. He prefers this mode to plastering his corn in the hill, as more beneficial to the corn and to the land. About the 1st of March, and not earlier, for Mr. Weaver prefers spring to winter ploughing, being more recent, it leaves his land looser and in better order for a crop, he commences breaking up his corn ground, as deeply as possible, with McCormick ploughs, drawn by two stout and fat mules, running around his hills, so as to throw all the furrows down hill. About the 1st of April he lays off his ground in rows in the same direction, 4½ feet apart, and drills his corn very thick, as he never replants. His usual allowance is a bushel of seed to five acres. With this quantity of seed he has never failed, notwithstanding the depredations of the grub worm, &c., in obtaining an abundant stand of plants. He commences ploughing his corn with the ordinary shovel plough, as soon as he has finished planting, by which time his first planting is generally well up. He ploughs and hoes twice, thinning at the first hoeing to the distance of about 2½ feet in the row. This is all the work his corn ever gets, and he always lays it by before harvest. He endeavors to finish working his corn as early as practicable, in order to injure the roots as little as possible. With this cultivation his corn field, under his system of improvement, is kept throughout the season both clean and loose—the great points in the management of the corn crop.

This year Mr. Weaver has 200 acres in corn. He commenced ploughing the 1st of March with six McCormick ploughs, drawn by two stout mules each; and, with the assistance of his overseer and six additional hands, he finished planting the whole 200 acres by the 7th of May, having in the meantime, with the same force, broken up and seeded ninety acres of oats. Since planting, the whole 200 acres of corn have been cultivated by twelve hands, six ploughmen and six hoe hands, and six mules, and was laid by at harvest, about the 1st of July. Seventy acres of the corn on the home farm were ploughed and hoed only once, the corn having been previously harrowed in the row with heavy two-horse harrows. This field, which was a clover ley, will probably yield about 40 bushels to the acre. Mr. Weaver confidently estimates his entire crop of corn this year at not less than eight thousand bushels. His 90 acres of oats were supposed to average between 40 and 50 bushels to the acre—making, with his corn, an aggregate crop of twelve thousand bushels of grain, as the product of the labor of 12 hands, with the above-mentioned teams, for the brief period of four months. His is what I would call very energetic and successful farming. Is it excelled, or even equalled, by any other farmer in the United States, under any thing like similar circumstances?

Mr. Weaver has a field of 40 acres on his home farm, which he cultivates for two successive years in wheat, and two in clover for hay and seed. His first wheat crop, on the clover ley, has averaged, by actual measurement, thirty-six bushels to the acre, weighing 60 lbs. to the bushel. The second crop is never as heavy as the first. He has frequently made two hundred barrels of flour from his wheat crop on these forty acres—being an average of twenty-five bushels of wheat to the acre. Mr. Weaver does not object to taking several successive crops of corn or wheat from the same land, *provided it is rich.* He contends that it is necessary to take two successive crops of wheat from his clover field, in order to cleanse and pulverize it sufficiently to secure a good stand of clover. It should be stated that considerable quantities of manure from Mr. Weaver's barn and stables are applied to this field, on the young clover. Mr. Weaver uses all his manure as a top-dressing to his grass lands and clover lots. He disapproves the practice of ploughing under manure.

Mr. Weaver's standing pastures are the finest I ever saw, consisting of a most luxuriant growth of white clover and green-sward. The only objection to them is, that they are too much infested with "rich weed," as it is termed, and thistles,

which Mr. Weaver has not had time this year to destroy, in consequence of his unusually heavy crops, and the destruction of his iron establishment, saw-mill, and a long line of fence, by the July freshet. He fattens upon them a number of bullocks, besides keeping a large dairy stock of very pretty cattle.

Mr. Weaver's stock of every kind, horses, of which he has very few, mules, cattle and hogs, are of a very fine quality, and are all kept constantly fat—the most economical and profitable mode, as Mr. Weaver contends, of keeping stock. He crushes all his corn for stock-feeding in the ear, and he considers his crushing machine as the most profitable upon his estate. PLOUGHBOY.

Rockbridge Co., Va., August 29, 1842.

SALT FOR THE GRUB WORM.

From the New Genesee Farmer.

Mr. Colman—In examining a neighbor's field of corn, I perceived some of it cut off by the grub worms, and deemed it best to examine my own. To my surprise I found they had been destroying my own at a great rate; and had made their way into the garden and were engaged in cutting off the cabbages at the rate of four or five every night. It appeared that they did not touch them by day; and when I went out in the morning I found my cabbages gnawed off close to the ground. I first applied ashes to the hill, but without effect; then soot, but it was like the wind and did not affect them. Scotch snuff was then recommended to me, but it availed nothing against them. The June number of the New Genesee Farmer, however, arrived about this time, in which it was stated that salt was so disagreeable to the grub that it would effectually protect the corn and cabbages. I had tried every other preventive which I could hear of, and determined to make an experiment with salt. I applied, therefore, about two table spoonfuls of salt to each hill of corn or cabbage, and laid it so as not to touch the stalk or plant. Not one has been molested by the worms since, though they have begun to eat the weeds in the vicinity, to which I do not make any strong objection.

I send you this statement for the benefit of farmers. From a three years' subscriber.

Yours truly, R. H. Jr.

East Bloomfield, Aug. 6, 1842.

* * * * *

Lands in the vicinity of the sea, where sea-weed and sea-wreck are easily obtained, are, with few exceptions, essentially benefited by the application of sea-weed, rock-weed and kelp, either simply spread upon the grass land or spread and ploughed under. Much of the benefit in these cases is supposed to be due to the salt with which these grasses are impregnated. We have often applied them with the most decided advantages. One of the best farmers of New England, living near the sea, assured us that he estimated the value of salt hay, that is, hay cut upon lands customarily flowed by the tides of the ocean, as equal to five dollars per ton as a top-dressing for his grass land. We have known, likewise, upon six acres of land, dressed chiefly and most liberally with rock-weed gathered on the sea shore, a crop of upwards of twenty-nine tons of hay, weighed, when well cured, at the town scales, to be taken in one year; and we have been familiar for years with a field of about forty acres, annually manured with rock-weed, kelp and sea-wreck, where the ordinary yield was estimated at 120 tons upon the forty acres; and as this hay was almost wholly carried to the market, there could be no essential mistake in the estimate.

These facts present the subject of experiments with salt as a manure as matter of great importance; and as the cattle in the interior, remote from the sea influences and atmosphere, require frequently this condiment or seasoning of their food to be given to them, may it not be inferred from analogy, that lands remote from the sea may be in some degree deficient in this element of fertility, and receive an equal benefit from its application?

The use of salt as a manure is not new at all; but while it has been fully settled that a certain amount is almost invariably beneficial, any excess is directly pernicious. To determine the safe medium is greatly to be desired and can only be ascertained by repeated experiments judiciously made; and in which all the circumstances are carefully noted.—*Ed. N. G. Far.*

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Since sending to the press the communication of R. H. Jr., on salt as a protection against the grub worm, we have received the subjoined, confirmatory of the foregoing, which we have much pleasure in inserting, and beg that we may again and often hear from our correspondent.—*Ed. N. G. Far.*

Extract.—London, Canada, 15th August, 1841.

I should be glad, through your columns, to thank the individual for his article on applying salt to plants to kill the grub, (not the gentleman who recommended a table spoonful to each plant, but the one who applied it to the plants at the rate of a bushel to the acre). Previous to reading this article, I had tried several things and had planted over and over again and again, but my plants were as quickly destroyed, and I was about to give it up as a failure, when your number came to hand and I saw the article on salt. I immediately put about a pinch to each plant, which I repeated a second time, and I had no more grubs. We had, however, at this time moist weather.

On mentioning this remedy to a friend, he said he could then account for a fact, which before had to him appeared a mystery. It was this: when he set out his plants (cabbage) he watered them with water from a salt-pork barrel daily, for about a fortnight, during which he had no grubs; but thinking the cabbage plants had sufficient root, he discontinued, and soon after he found the grub attack his plants as much as his neighbors'. The salt in season enabled me to have cabbages in season; and should I receive no other benefit from the perusal of your N. G. Farmer than this simple cure, I shall consider my half-dollar well laid out. X FARMER.

TO PROTECT LAMBS AGAINST FOXES.

We happened to be in a hardware store the other day, when a farmer came in and inquired

for sheep bells. He said the only way he could protect his lambs against the depredations of the foxes, was by putting bells on a few of the sheep in his flock; when this was done, the lambs were safe. We thought the hint worth remembering, and have put it down here for the benefit of our readers.—*Farmers' Gazette.*

SPLENDID INSECT.

From the Baltimore American.

There is now at the Baltimore Museum an insect of the *glowworm* tribe, that surpasses every thing of the kind of which we have any record. It will be recollected that the common glowworm is about half an inch long, and that it is only luminous on a portion of its abdomen. The insect at the Museum is two inches and two-thirds in length, when fully extended, and is still growing; it is one-third of an inch wide; has 12 rings, the first, the second and third of which are furnished with a pair of legs each; and like the *Scholopendra* of naturalists, (of which this is supposed to be an undescribed species,) its light is not confined to one part, but proceeds from the whole body. When examined at night in a perfectly dark place, its luminous rays extend two feet each way. In such a situation it is one of the most beautiful objects imaginable. We have seen the celebrated fire-flies of the West Indies, but they are very far inferior to this in all respects. It appears to be filled with its peculiar greenish fire of the most intense brilliancy, which is emitted through every pore and aperture of the body. As before stated, it has but *six legs*, and in this it differs from the family of Scholopendra. By day light it resembles closely, in form and color the worm that is found in many kinds of wood, particularly hickory; but it is vastly larger, and its head is also different, being much smaller and of different form. The head is capable of being retracted or drawn entirely within the first ring. Probably this description will enable some naturalist to ascertain what it is. The insect was found near Deer Creek, in Hartford county, in this state, on the surface of the ground.

CLOVER HAY.

To the Editor of the Farmers' Register.

Allow me to call the attention of my brother farmers to two articles published in Vol. i. of the Register, the first at page 169, on clover hay, the second at page 162, by C. W. Gooch, on hay making. In the management of my clover hay this year, I followed strictly the instructions therein contained, and I have every reason to be satisfied with the result. The hay is sweet, with green stems, cured without loss of leaves and blossoms, and is eagerly devoured by the horses. Notwithstanding my two great disadvantages of bad weather and great distance of the clover field from the homestead, the whole crop was secured with less trouble and loss than it could possibly have been done by any other mode of management. As many of your present subscribers may not have the first volume of the Register to refer to, I will briefly state the plan I pursued.

The mowing was commenced each morning as soon as the dew was off. The clover laid as cut in swath, until about 2 P. M., by which time it was fallen or wilted. The cocking then commenced, and all was put in cock which had sufficiently wilted, say all that was cut prior to 3 P. M. The cocks were made about 4 to 4½ feet in diameter at the base, and about 5 feet high. When about 3½ or 4 feet high a *skewer*, as recommended by Mr. Gooch, was run perpendicularly into each, and the hay cocked upon it. In cocking, the hay was left loose and light. The object of the skewer is to prevent the cocks being upset, or the tops blown off by high winds, which it did far beyond my fullest expectation. I did not use the skewer at all the first day of my operations. On the second a storm of wind and rain came, and the top of nearly every cock was blown off. After adopting the use of the skewer, which was immediately done, there was not a single cock injured by wind. Besides, with the skewer, the cock can be built higher, and the hay seems to remain looser, and thus permit a freer circulation of air. I think the use of the skewer a matter of the utmost importance. The second and each succeeding day, as soon as the dew is off, the mowing is again commenced, and in two or three hours afterwards the women begin to put into cock the clover cut on the latter part of the previous day, and by 2 P. M. they get to the cutting of the same morning. My object in always waiting till the dew is off, before beginning to cut, is to save all trouble of turning it, for it is necessary when put into cock that it should be free from any dew or rain water.

This mode of curing hay is much the safest in bad weather, for if a rain comes after the hay is in cock, it does not penetrate so deep but that it will readily dry again, and if it comes before, the clover being in a green state is very slightly damaged. After standing in cock four or five days, if the weather is good, the hay is ready for housing. I have begun the third day to put it loosely in open lofts, without damage. The only loss I sustained this year with all the disadvantages of a very wet season, was in the very bottoms of the cocks. Where the hay remained long in contact with the wet earth, it became mouldy. The cocks were always opened, and the hay exposed to the sun two or three hours just before being hauled to the house or stack.

For skewers I used tobacco sticks, which are four feet long, sharpened at each end. R. J.

ON THE EFFECT OF CARROTS ON HORSES.

From the New Genesee Farmer.

Sir.—In answer to a query in your excellent paper of the 10th inst., respecting feeding horses on carrots, I am unable to give your correspondent any lengthened experience on the subject; but since I have given my horses (twelve in number) carrots, I have not perceived any ill effects from them, neither have I ever heard the root accused of injuring horses' eyes before; but the chief reason of my replying to your correspondent, is to inform him that the parsnip, a root having great affinity to the carrot, is thought to have this effect, as he will perceive from the following quotations from Quayle's Agriculture of the Islands on the

coast of Normandy, drawn up for the consideration of the late Board of Agriculture. Under the head, Parsnips in the Island of Jersey, he says: "Horses eat this root greedily, but in this island it is never given to them, as it is alleged when kept on this food their eyes are injured." Again, in the Island of Guernsey, he says:—"To horses, parsnips are frequently given, and have the property of making them sleek and fat; but in working, they are observed to sweat profusely. If new, and cut sufficiently small, no other ill effect results, except indeed, at one period of the year, towards the close of February, when the root begins to shoot; if then given, both horses and horned cattle are subject on this food to an inflammation in the eyes, and epiphora or weeping; in some subjects perhaps producing blindness." Trusting the above extracts may prove interesting to your correspondent. I remain, &c.,

A Devonshire Farmer.

DOMESTIC FOWLS IN WINTER.

From the Albany Cultivator.

One of the greatest errors that prevail in the management of the domestic fowl, and one which must be destructive of all profit, is the common practice of leaving them to "shirk for themselves," during the winter months. There is no animal on the farm that better repays good keeping than the hen, and with it, the rest, none that affords so much profit on the capital employed. The hen should have a close warm roost, for there are few creatures that suffer more from the cold than fowls; they should have a box of gravel, sand, ashes, &c., for them to roll and dust themselves in, to prevent the attacks of those insects to which fowls are subject; they should have access to pulverized limestone, or limestone gravel, as this will give material for shell, and contribute to the health of the hens; they should have abundance of water, clean and pure, for few animals will drink more frequently or eagerly than the hens, if water is within their reach; and no one need expect healthy fowls, or a plentiful supply of eggs, who does not pay strict attention to their supply of food. Indian corn, peas, buckwheat, oats or barley, may be fed to fowls. Potatoes, steamed or boiled, are excellent food for them, but must be fed while warm, as fowls will not eat a cold potato unless driven to it by hunger. Fowls should have access to a warm yard in the sunny days of winter, as warmth is particularly invigorating to them. If confined for any time in a close ill-ventilated room, they will become diseased and feeble, and will require extra attention to repair the evil generated.

KILLING WORMS.

Hellebore, it is well known, is an active poison, and fatal to most animals, and in the form of the powder of the shops, or in a strong decoction, has proved a most efficacious agent in freeing gooseberry and currant bushes from the myriads of worms that at times infest them. If used dry, the powder is dusted over them from a flour box; if in decoction, from the nose of a fine rose watering pot. A writer in the Gardener's Chronicle, says that he mixed the powder with soap suds, watered his bushes, and in six hours the bushes were free from worms, they having fallen dead by thousands. Might it not be used to destroy other worms as well as these?—*Cultivator.*

RYE FOR WINTER AND SPRING FEED.

To the Editor of the Farmers' Register.

On opening the Register this morning, the first article which met my eye is of much importance—sowing rye for winter and early spring feed. I have been an eye-witness of its beneficial results. Gen. David R. Williams was one of the very best planters on the waters of the Great Pee Dee, and was the first to turn the attention of the planter to the improvement of his lands in this section. He was not only the best, but decidedly the neatest and most systematic I ever knew. I was frequently on his plantations. He, years before his death, made a communication to the editor of an agricultural paper in Charleston, S. C., if my memory does not betray me, to this amount: Sowing largely of rye and oats; the rye somewhat pastured in the winter and spring, the stock taken off in time to permit the rye to recover from the effects of grazing, so as to give a fair remuneration in grain. His work horses and other stock permitted to gather the grain (rye and oats) at maturity, leaving the straw on the lands. The general always considered his lands as benefited—his stock certainly was, and with truth particularly the hog—portions or the entire field was frequently sown in pease. The general was the first to establish any thing like a regular system of penning his stock winter and summer. I consider him as great a loss to the agricultural community of Pee Dee, as to the state, in a political point of view. His industry, ardor, good judgment, fund of useful and practical knowledge, urbanity of manners, together with the neatness of every thing by which you were surrounded, made a visit to his plantations a most delightful recreation. But I did not set out to eulogize the general, but to use him as authority. As it regards the rye, oats and pease, they *all* met his approbation, (for he practised the use of them,) as improvers of the soil, and, to a considerable extent, the rye, as beneficial to stock, both for winter and spring grazing, as well as in the manner above stated. And here, sir, where we are unable to have our clover fields, as with you, small grain and pease are invaluable for stock, and where fed off on the lands, (except in our stiffest clay lands, on which the stock should not be permitted to run,) the benefits are great both to stock and lands. Pee Dee.

SHIPMENT OF BONES.

The ship Savannah recently cleared from Philadelphia, with a cargo of 400 tons of bones, which were purchased at $12 to $13 per ton. —*Cultivator.*

ON OAT HAY.

By William Steuart, esq. of Glenormiston, Peeblesshire.

From the London Quarterly Journal of Agriculture.

Having a field of about 14 acres which had been partially furrow-drained in 1839, and from which a crop of oats had been taken, to prepare for green crop, finding there were about 4 acres which required complete draining, and that it would be the better of extra working, I determined upon sowing it with oats to make hay of; this I did on the 11th March, sowing 26 bushels on the 4 acres without any dung. So soon as the flower was a week out of the shot blade, 27th July, I began mowing. The field was cut down by 30th; was made into hay and put into ricks by 7th August; and was then carted into the barn-yard, after standing a few days in rick, and put into tramp-ricks of 3 or 4 carts each, for the convenience of leading into the hay-loft. The produce of the above 4 acres was 692 stones of 22 lbs. The horses preferred this fodder to every other kind of hay; and I have now before me my farm-steward's letter of 8th instant, says, "The horses getting common oat fodder are in fairish condition, but those getting oat-hay, eating the same quantity of oats, and doing the same work, are as fat as they can be." The oat hay field, after being sufficiently drained and cleaned was sown out with wheat, getting a dunging of 20 square yards of dung per acre.

Annexed is a statement of the expense of the oat-hay experiment.

Cost of 26 bushels oat seed at 20s. per boll,	£4	6	8
Harrowing, water-furrowing, and rolling,	1	16	0
Mowers from 27th July to 30th July,	1	1	0
People working to 7th August inclusive,	0	18	6
Leading, stacking, &c.,	0	13	6
	£8	15	8
692 stones oat-hay, at 6d. per stone,	17	6	0
Leaving a clear profit of independent of the manure.	£8	12	4

ORCHARDS.

From the Memoirs of the Philadelphia Agricultural Society.

Burlington, February 5th, 1808.

Dear sir,—The opinion that clover possesses some property injurious to the growth of apple trees, had been suggested to me by several men of observation and practical information previous to the receipt of your letter of last spring. Some of my own experiments in the planting of orchards had not succeeded to the extent of my expectations, and their failure was ascribed to the cultivation of clover. I was well convinced of the beneficial effects which had been derived to the agriculture of our country from the introduction of clover, and being desirous of availing myself of its ameliorating properties in the improvement of my farm, I was alarmed by an apprehension of its interference with a favorite scheme I had in contemplation; that of enriching my neighborhood and improving my own property, by the introduction of the finest table and liquor fruits of Europe and America, into an extensive orchard establishment on my lands in the vicinity of this town. I therefore determined to ascertain the truth of the opinion by a series of experiments. These I have executed with care; and the result has perfectly convinced me, that young orchards thrive in proportion to the goodness of the soil, and the degree of cultivation bestowed on them; that the injury they sustain from grass or grain depends on the extent to which the particular growth or nature of that grass or grain may prevent the communication of moisture and nourishment to the roots of the trees from the earth or atmosphere: that so far as clover produces this effect, it is injurious; but that it has nothing in its nature peculiarly deleterious. On the contrary, its long tap roots penetrating and dividing the soil increases very much its capacity to nourish the roots of the trees; and did it not afford an inviting food to field mice and moles, it would be found less pernicious to orchards than any permanent grass, or any species of grain which shall be permitted to arrive at full maturity on the ground, buckwheat alone excepted. The point of most importance in the planting of young trees is to preserve the roots so near the surface of the earth, that by keeping the soil around them in a loose and mellow state, free from weeds, grain or grass, they may feel the salutary influence of the sun, air, and rain; the last of which in our dry climate is particularly essential to their success, for several years after planting; for this reason all kinds of fallow crops, such as potatoes, vines, and Indian corn, particularly the last, are peculiarly adapted to the first and second years' cultivation of orchards. An opinion prevails among our farmers that rye is a more pernicious crop for orchards than any other grain; for this I can see no sound reason. I am induced, from my own observation, to believe, that all grains are injurious, in proportion to their proximity to the tree, their power of exhausting the moisture, and from their color or even surface producing a great proportion of intense reflected heat. I am so fully convinced of this truth that I have the last summer caused a circle of three to six feet diameter, to be dug at two several times round every tree in my orchards, not under the plough, whether among wheat, rye, oats or grass; and although this operation when extended to several thousand trees, which at present compose my orchards, necessarily is productive of much expense and trouble, I am repaid fourfold in the increased vigor of my trees, and still more in their preservation from our summer droughts. Although I pretend to the merit of no new discovery in the cultivation of orchards, I may claim that of sparing no pains or expense in planting, pruning, and cultivating them. That you may be able to judge of my mode of treating them, and the foundation for the opinions I have ventured to offer, I have taken the liberty of extracting from my books the notes of several of my experiments, which I can venture to assert were made with care and recorded with accuracy. I have for many years derived a great degree of pleasure from the pursuit of this subject; it is in its nature calculated to afford

much rational enjoyment to an active mind, and, if I am not much deceived, will prove a source of substantial comfort and profit to the prudent practical farmers of our country. If my exertions can in any degree add to the numerous inducements which already exist, to urge our landed gentlemen to improve their estates by plantations of the finer kinds of table and liquor fruits, I shall be amply rewarded for the time and money I have expended in the pursuit.

Experiment No. 1.—In the fall of 1794-5, I commenced the plantation of an orchard on a good loamy soil and in a favorable situation. Being a novice in the business, and having no correct information, for at that time a young orchard was a perfect novelty in my neighborhood, the holes were dug very deep and narrow, with the mistaken expectation of its being necessary to support the trees. The ground was for several years kept in clover, and part of it being rather stiff, the natural green grass prevailed over the clover, so as to injure the trees extremely. The trees grew slowly; many of them have since been taken up and replaced by others planted in shallower and wider holes; the latter plantations have gained fast upon the first; and since I have had the ground around the trees dug or ploughed, the whole orchard containing about three hundred and forty trees, grows vigorously, and has a uniform appearance.

No. 2.—In the fall of 1802, I began another orchard, which in the two following seasons was enlarged to about three hundred and forty trees. These trees were large and vigorous. The holes were dug wide, and the ground around them manured highly with stable dung the following winter. The ground being in clover remained uncultivated for two years. The drought of the two following summers killed many of the trees, and the field mice which found a comfortable winter shelter destroyed many more. The orchard did not flourish in a manner which the goodness of the soil and my great care led me to expect. I determined therefore to plough it thoroughly, and to break in upon my established course of crops for the purpose of recovering the trees by cultivation. The event has fully answered my wishes; the trees now flourish with uncommon vigor and at present exhibit a promising appearance; being now so large as to be completely established and out of danger.

No. 3.—In the fall of 1803, I planted forty-five trees in a lot adjoining to No. 2. The trees were not large, but the ground being under constant cultivation they grew rapidly. None of them (one excepted) died by the drought of the following summer, which proved so destructive to their neighbors in the clover ground. It was my observation of these trees which first led me to change my mode of treating my young orchards.

No. 4.—In the fall of 1804, I planted four hundred and eighty-four trees in a clover field. The holes were dug four feet wide, two spits deep; the lower one thrown away, and its place supplied by a compost manure, composed of stable dung, a small portion of river mud and a large proportion of lime, about a wagon load of the mixture was applied to six trees; in some instances it was mixed in the holes with the earth in planting, in others it was thrown around the tree on the surface after planting. The ground remained in clover unploughed and undug the whole of the following summer. The trees put out well the first spring, but the drought of the succeeding summer prevented their growth, those which did not perish were nearly stationary. I replaced one hundred and thirty of them the following fall, since which I have replanted nearly one third more, and have kept the ground in corn for two successive years, by which means the surviving trees have perfectly recovered, and together with the replanted trees at present exhibit a uniform and vigorous appearance, promising in every respect to be a fine orchard.

No. 5.—In November 1805, I planted three hundred and eleven trees adjoining to No. 4. The holes prepared in the same manner, many of the trees large, transplanted a second time; I mixed no stable dung with the compost, which was composed of river mud and ashes with a small portion of lime. This I put round the trees on the surface, a wagon load to ten of them. The ground had been previously planted with corn. Although generally deemed an exhausting crop, I have continued it in corn for three successive years; except part, which has been constantly occupied (to adopt the language of this part of New-Jersey) in a truck patch. These trees have grown with a vigor I never saw equalled. In two years but one has died, and that was lately destroyed by the field mice; and the orchard is allowed to be the handsomest in this part of the country.

No. 6.—In November 1805, at the same time with the preceding experiment, I planted two hundred and fifty-two trees on a corn fallow; the holes prepared as in No. 5. I applied stable manure, hauled out the preceding spring, in about the same proportion around the trees. In the following spring the ground, which was in high order, having been manured with about three hundred bushels of leached ashes per acre, was sown with oats: the oats grew finely, and the trees put out very beautifully. They grew well for some time, but as the oats by their growth exhausted the moisture from the earth (which had not been dug) the trees withered, and by the time the oats ripened about forty of the trees had perished. As soon as the oats were cut I had the ground ploughed. This checked the destruction of the trees: those which had not previously perished soon recovered, in some degree, a healthful appearance, and took a second growth in the autumn. The trees replanted and the survivors of the original plantation have been dug round twice in the last season, and although the ground has been sown with wheat and is now in clover, they generally look well and promising, but in no degree to be compared with those manured with the compost of mud, ashes and lime, and kept under cultivation.

No. 7.—In October 1806, I planted part of an orchard of two hundred and ten trees, which I completed in the following December; the ground prepared and manured with ashes for a corn crop; the trees planted and manured with stable dung hauled out the preceding spring. In the spring of 1807, the ground was sown with oats. All the trees planted in December, and dug after the oats had attained to some size have grown well. Of those planted on the 24th of October, one third part perished in the following summer, which I

attribute to their being transplanted before the sap had ceased to flow. This remark applies particularly to the Hewe's crab, which continues to grow later in the fall than any other apple tree. Some kinds did not suffer at all, while the greater part of others perished. The comparative effects of the dung and mud are observable in this plantation.

No. 8.—In the month of October 1806, at the same time with the preceding experiment, I planted about one hundred and eighty apple trees on a piece of ground ploughed for, but not sowed with, oats the preceding spring. The holes were dug, and the trees manured with stable dung, precisely in the same manner with No. 7. The soil was much sandier than either of the fields mentioned in numbers 6 and 7. The ground was full of weeds and very rough. In the following spring it was manured with ashes, and planted in corn. Forty of the trees had been procured from a distant nursery, the soil of which was so stiff as to cause much injury to the roots in digging or rather grubbing them; they were extremely short so as to leave me little expectation of their growing in my light soil. Notwithstanding all these obstacles the trees, though planted on the 24th of October, from being under cultivation have generally grown finely, and at present exhibit a favorable appearance, few of them having perished, and those few principally from the field mice; but the difference between the mud and dung is here also very perceptible.

From the result of the foregoing experiments I infer, that trees planted without manure in the holes, and the roots covered with the surface earth with an external covering of mellow mud or rich mould, is the best mode for the first year. That if the ground is poor, stable manure is the least proper kind to be used, being from its nature least able to resist the destructive effects of our summer droughts, and affording a shelter to vermin equally pernicious in the winter, particularly in light soils; that rich earth or river and meadow mud ameliorated by frost or putrefaction, either in its simple state, or mixed with ashes, lime or perfectly rotten dung, is of all others, after the first year, the best dressing, to be spread on the surface and ploughed in. That cultivation is essential to the growth of orchards, which thrive in proportion to the degree of it which they receive.

I have, under a full conviction of the correctness of these opinions, this fall planted another orchard of four hundred and eighty trees, one half of European, and the other half of American kinds, in a light, sandy soil, with two cart-loads of meadow mud, spread in a circle of about 10 feet diameter round each tree on the surface of the earth. This ground I mean to cultivate in corn and other fallow crops for two years, when I hope the trees will be sufficiently established to admit of winter grain and clover. This is the mode I prefer from my past experience, and I have little doubt of its complete success, especially if the further precaution of digging once or twice round each tree in each season is attended to (whether the ground be sown with grain or clover) for two or three years. It may not be amiss here to mention, that I do not include buckwheat in the pernicious list of grains, because it keeps the ground in a loose state, and ripens at a season of the year when no injury is produced by it to the trees; and from its peculiar growth and color, I doubt whether buckwheat ripening even in July, would produce a sufficient degree of reflected heat to be injurious to an orchard. I am, dear sir, with sentiments of esteem and respect, your obedient servant,

WM. COXE.

SOME ACCOUNT OF THE GREEN-SAND EARTH OF GLOUCESTER AND SALEM COUNTIES, NEW JERSEY, AND THE EFFECTS AS MANURE.

By the Editor.

The New Jersey green-sand earth, and the beneficial and wonderful effects produced by its use as manure, have long been subjects of interest and curiosity to every person accustomed to read or to hear of the progress of agricultural improvement in the United States. There were other additional reasons, (which will be obvious to all readers of the past volumes of the Farmers' Register,) which made me take especial interest in this subject, and to seek information thereupon, as I have done for a long time past, from every source offered by publications. Still, all such information, taken together, seemed to me loose and vague, and deserving but little confidence; while the reports and statements of practice deemed most authoritative were manifestly erroneous, to my judgment, and serving to deceive, in their reasoning from facts, even if the facts themselves could be relied upon. The only truths which seemed certain, and these taken in the general, were that the green-sand earth of New Jersey was valuable as manure, had been extensively applied, and had in very many cases produced great improvement to the land and profit to the farmers. The error or deception which was indirectly (and perhaps undesignedly,) but not the less certainly conveyed, by the general and combined purport of all the published statements consisted in the omitting to state the particular exceptions to the above general positions—and which exceptions, even before my having any direct evidence or even report of their occurrence, I was well convinced *did* exist, and were important in every aspect. And much more of delusion had been produced in Virginia, through the high, though unmerited authority of the geological report of that state, by its author's assuming the received opinions of the fertilizing effects of the green-sand earth in New Jersey as entirely applicable to the green-sand earth and the soils of Virginia. In advance of or absence of all facts, this would have been a legitimate and fair inference. But not so, as it was made and has been long persisted in, in opposition to all existing testimony of known facts, or in neglect, or omission and contemptuous disregard of all known facts and practical experience.

Deeming, from every thing yet read, that there would be no means of obtaining the correct information desired except by personal examination, I determined to visit the green-sand region of New Jersey; and to make this personal inspection, and to have opportunities for making personal inquiries, formed the sole objects of a journey from my distant place of residence.

Even when on my journey, and when making

general inquires as to the best mode of directing more particular inquiries, I heard repeated, by intelligent and highly respectable gentlemen, and who were residents of New Jersey, but who were not farmers, such accounts of great improvements made, as very short subsequent observations showed to be very erroneous or at least requiring to be taken with much limitation. Still I knew that even after arriving on the ground, and seeing the deposites of earthy manure, and the land and the crops for which it had been used, I must rely much less on what I could see myself, than on the explanations and comments of other persons. Therefore, it was the most important means for my object to find persons whose experience, judgment, and perfect respectability and veracity could leave nothing (except unavoidable mistakes and errors of judgment,) to impair the value of their testimony. In my search for the aid of such testimony I deem myself very fortunate, and altogether successful.

As soon as I arrived in Philadelphia, I called to make the personal acquaintance of Josiah Tatum, the proprietor and one of the conductors of the Farmers' Cabinet. I found him, even more than was previously expected, well qualified, by his personal and intimate acquaintance, to direct my course, and also ready to aid me by his kind and very useful attentions. He had been long, and until very recently, a resident of Gloucester county, and a part of the region in question, had been there a practical farmer, and had a general knowledge of the land of the neighborhood, and of its residents and cultivators. He offered to accompany me forthwith, and to make me welcome among his friends; and the same evening we were among them, in the neighborhood of the village of Woodbury, in Gloucester. The persons sought, and who most kindly aided my examination by their company and information, as well as by their kind hospitalities, were like my brother agricultural editor, Josiah Tatum, all members of the plain and estimable society of Friends, or Quakers; which connexion, to me always serves, in the absence of other testimony, as indicating solid worth of habits and character. William R. Tatum is the proprietor, and Benjamin Whitall the manager for his father, of their respective well cultivated, and highly improved farms, which are large for that part of the country, being each from 160 to 175 acres of arable and meadow land; and they are good and successful farmers in general, as well as extensive and regular buyers and users of the green-sand earth as manure. Both have made great improvements by the use. Joseph Whitall, the aged father of Benjamin, and long the proprietor of the farm, was so infirm and so unwell at the time of visit, that I feared to fatigue him by too many questions; but still, what he stated was especially interesting and valuable, because of his very long experience and general acquaintance with the subject. I may be permitted to add that all these four were intelligent men, apparently well instructed by education and reading, and of good general information. The experience and good judgment of the three who were yet farmers, as to the particular mode of improvement concerning which I was seeking information, were sufficiently evidenced in the success visible on their well improved farms.

The farm belonging to William R. Tatum is on the small tide-water creek, which extends from the Delaware to Woodbury; and of course his land is below the head of tide, and also is off from the true green-sand formation or deposite, which stretches nearly through the state just above the head of the tide in the creeks running into the Delaware. The position is therefore precisely the reverse of the green-sand deposite of Virginia, which is wholly in the tide-water region, and terminates precisely with it on the western side. The farm of Whitall, and all the others visited in this neighborhood, except Tatum's, were above the head of the tide-waters of the creeks, and all within the distances of from one to six miles south-east of Woodburry.

The first of the diggings reached and examined was on the farm of Joseph Whitall. This is very different from and deemed much inferior to the usual and most highly prized green-sand earths, though called by the same improperly applied name of "marl." It is a clay of smooth fracture and nearly uniform texture, almost black, or of dark plumbago color when newly dug and moist, but approaching to pale blue or lead-color, when dry. When cut by a knife, a smooth surface is left, as in fine clay or clay marl. It has many shining particles of mica diffused throughout. Some small fragments of shells are visible —but not enough to make two per cent. of the mass, and more likely not one per cent.; and therefore this ingredient can have no appreciable effect as manure. This earth I presume is what Prof. H. D. Rogers, in his Geological Report of New Jersey, terms the "black micaceous sand."

The next digging visited was near the road to Blackwoodtown. The earth lies about three feet, or less, under the level surface of a wet meadow, and above the green-sand earth is bog iron ore. No benefit to the soil has been observed from the close neighborhood of this manuring earth below. This deposite is something like that of Whitall's, but has more of green-sand, the granules of which are plainly visible to the eye in part of the earth, without being separated for examination.

The third body seen was Cooper's, at Good Intent. This was formerly used by neighboring farmers as manure, and to benefit, but has been abandoned since better and as accessible beds have been opened. This kind approaches somewhat in appearance to the upper and poorer parts of the bed of gypseous or green earth on James river. But this is much harder (almost stony) and more difficult to dig—is partly of a dull green changing into and intermixed with brown—and showing small spots of the same sulphur colored clay, here indurated to stone, which is so common, and usually soft and plastic, in the green earth of James river.

The next three are of the true and most valued green-sand earth, here called "gunpowder marl." This earth (that is the lowest and best stratum of it) seems to be composed almost entirely of the superficially black granules, which give name to the earth—and which, though appearing to the eye like coarse black sand, are easily mashed on the finger nail, or on white paper, and thus shown to be in texture a fine soapy clay, making a bright green smear. There seem to be barely enough of other ingredients in the mass to hold these

granules together; so that it is difficult to dig a solid lump and prevent its crumbling into a coarse powder of the separate grains. Marshall's, Heritage's and Bee's earths, all of which have been regularly and largely dug for sale, agree in character. The several upper strata differ. Of Marshall's, the upper part is grayish, and though less prized, is bought at a lower price (12½ cents the load) by farmers who have to carry it only a mile or so. Of Heritage's and Bee's, the upper strata seem poorer, and more like the poor earth of Cooper's. Still these are also used by the farmers who buy the earth by the superficial measure, and who thus get the poorer upper part for nothing but the labor of digging.

Bee's earth (that is, its lower and best stratum) is reputed to be of somewhat less value as manure than the two preceding. Yet it appears as rich in green-sand to the eye, and has been so reported, (within an inappreciable fraction,) by the geological surveyor.

The seventh body examined is very near the last, and also appears to the eye to be nearly or quite as good. Yet it has been used largely, by persons entertaining at first no question of its equal value, and found to be totally ineffective.

As to the high and just appreciation of the best of these earths as manures, there can be no question. The very general use made of them, the prices at which they are purchased, and the distances to which they are transported by very many farmers, furnish full and satisfactory proof on these points. Nevertheless, when proceeding to inquire into details, and to endeavor to ascertain and fix correct general rules by comparing particular facts, the inquirer will be surprised and confounded at the apparent opposition of the opinions of respectable and experienced persons and of the best authenticated facts. The cause and manner of the action of this earth as manure seem indeed to be incomprehensible in all respects.

The agricultural public have been egregiously deceived by the general purport of the published reports of the use and effects of this manure. Even if all the particular statements were true in themselves, (which it is not my design in the least to call in question,) still they led readers to very false deductions, because they were merely statements of success, and generally of the greatest known success, and of unusually small dressings of earth, without being accompanied by even so much as a hint of the existence of the numerous exceptions and opposite results. If these writers, had told of the cases of entire failure, or of minimum effects, in company with the maximum products to which they confined their testimony, or if the heaviest applications had been presented as prominently as the lightest, their readers might have at least had a chance to guess at something like the truth. As it is, every thing that has been published, from the ambitions and dignified reports of geologists, down to the most unpretending and concise communications to an agricultural paper, have served to mislead rather than to inform, as to general results, and to spread as much of error as of truth. The well established and unquestionable benefits of this manure are so great that they need not the aid (even if such aid could be ever desirable or excusable) of deception, whether to be effected by the bolder course of the *assertio falsi*, or merely the more usual and cautious and equally effective *suppressio veri*.

As to general results, I also could tell of many wonderful effects, and great profits, and of such (in their visible effects) as I have personally witnessed the proof. Sundry such results I have even this day seen and of many more have I heard, upon authority as satisfactory to me as would have been my own personal viewing. But the exceptions to the operation of each particular kind of earth, or found on each one soil, and in each man's practice, were stated to be not less numerous, and as remarkable, and inexplicable.

For my facts to be stated in regard to this neighborhood I shall be entirely indebted to the four persons before named, and in whose intelligence, sound judgment, and experience and opportunity for observation, as well as veracity, I have every reason to rely fully. All of them have been raised and have long lived in this neighborhood; all have been, and two of them still are, active and practical cultivators and users of this manure—and all are fully convinced of its great benefit and profit.

This earth is mostly applied in winter, when there is most leisure time; and on grass land, and as top-dressing. The quantity is seldom less than 10 tons, or as many 20-bushel loads of a two-horse wagon. The weight of the earth is 120 lbs. to the bushel when just dug, and more than 100 lbs. even after remaining and drying some months in large heaps. The usual price for the best stratum is 37½ cents the load, (of 20 bushels,) if ready dug, or from $10 to $16 the square rod, (16½ feet,) the buyer to uncover and dig for himself, and to go as deep as he may choose. The usual depth obtained of the lower and best stratum is 8 to 12 feet, below which it becomes too wet to be dug.

The surface of this part of Gloucester is gently and generally undulating. There are numerous shallow basin-shaped depressions, of moderately close soil, of which the subsoil is sometimes a hard pan of clay, but more usually sandy, and, at a few feet deep, wet, so that ditching is required to make arable or even good grass land, which is the general mode of occupation of all such places. The sandy sub-soil, from its wetness, often caves in as the ditches are dug, so as to make the operation difficult. The higher and dry intervals between all these depressions, are of all shades of texture, from sandy loam to almost pure sand. There is but little of this that could be called stiff soil, and none is at all clayey. Both the higher and lower lands are supposed to have been originally poor; and certainly so they seemed to me, judging by the parts not yet cultivated and improved, even though sometimes separated but by a fence from other ground highly enriched by the use of green-sand earth. The depressions known as "quick-sandy bottoms," and also those on hard-pan subsoil, are kept mostly in grass, and as long as fit for either mowing or grazing.

The manuring earth most valued (the so-called "gunpowder marl") produces its best effects on the stiffer soils, and especially on the lower-lying grounds, whether having a stiff clay, or a quick-sand subsoil. On these lands, (which form a large proportion of every farm in this part of Gloucester county,) the effect of the "gun-powder marl," or lower green-sand stratum, is almost

always and greatly beneficial; and that in the first season ensuing after the application in winter, and increasing for two or three years thereafter. On Joseph Whitall's farm such effects have already lasted more than 16 years without diminution. Still, the long-experienced proprietor does not think that this manure will do alone, but that it ought to be helped by putrescent manure.

On the stiffer high land this earth is beneficial, the more in proportion to the degree of stiffness of the soil. But on the very sandy soils, as most of the higher grounds are, this, the best kind of earth, is here held to be totally inefficacious and worthless. Yet on these sandy lands, the smooth bluish clay of Whitall (first described above) is remarkably and strikingly beneficial, while it is of no use whatever on the lower-lying land, where the other earth works so well. It is however applied much more heavily, where convenient to the fields. Joseph Whitall had commenced 37 years ago to use from his own bed, (the bluish clayey earth,) and as it was unluckily on his lower lands, it was without effect. The beneficial results reported to be obtained elsewhere (in Burlington county) had induced these, his first trials, and subsequently his resorting to other earths, from which he found some slight benefits. Still the general or average results were discouraging; and he, like many others afterwards, relaxed in his efforts; and it was only about 18 years ago that he learned how and where to apply each kind of earth, so as to profit by both, and by every application. One of his experiments will be stated. He applied his own kind, and also some of the best from Heritage's pits, side by side, on a part of his lower land, and in like manner on a high sandy knoll. On the former the "gunpowder marl" produced great benefit, and the other earth not the least whatever; while these effects were precisely reversed, and in as remarkable a degree, on the higher and very sandy land. On both the farms of Wm. R. Tatum and the Whitalls, the best green-sand earth is regularly and industriously used on the low lands, wagoned four and five miles from the pits where it is bought. Yet the former declares that he would not have it brought gratis on his most sandy land, deeming that its benefit would not pay him for the mere spreading. And the Whitalls, who by their practice give such strong evidence of high appreciation and preference, of their neighbors' "gunpowder marl," on low lands, have sold to other neighbors considerable quantities of their own (the black micacious clay) to be carried to their sandy lands.

But these are not all the strange contradictions which have served to cause error and loss, until they were better understood, as to *effects*, though the *causes* still remain as much hidden as ever. The seventh body of earth above-mentioned was stated *to appear* as rich in green-sand as the best, and which is very similar in all respects. Benjamin Whitall, entertaining no doubt of its value being equal to the best, worked at this body a whole winter, and put on his father's farm 150 tons. It produced not the least benefit, either soon or late. The same winter W. R. Tatum carried some of it to his farm. It remained inert for two years, but afterwards showed very good effect.

A similar fact was mentioned by Dr. Joshua Whitall, a resident of Burlington county, where it occurred. Abel Inskeep had been for some length of time purchasing and hauling green-sand earth several miles from a neighbor's digging. Afterwards he found on his own farm what appeared to be very much the same, and apparently as rich manuring earth. Of course he proceeded to use his own, and to save both purchase money and long carriage. But after full trial, and of course with every inducement to judge favorably, he was obliged to believe that his own earth was comparatively worthless, and to abandon its use, and return to the former source of supply.

It might be inferred that the chemical analysis of the different earths would show the causes of such difference of action. But, on the contrary, the analyses of chemists not only afford no such light, but if taken as directions would lead into still greater darkness. The qualities and comparative values of different bodies of earth as indicated by their chemical analysis, reported in the final geological report of New Jersey, do not accord with the opinions formed of their practical operation; and in some cases, some earths which would appear valuable by their chemical analysis, have been found to be totally worthless.

It is supposed, by the chemists, that the fertilizing ingredient of this earth is the green-sand contained; and that the potash, which is one of the component parts, is what gives value to the green-sand. There is generally not a particle of carbonate of lime; and never enough to be worth consideration; and of course this manuring earth is as little entitled to its common name in New Jersey of "*marl*," as its action as manure has of similarity to either what is called marling in Virginia, or in England.

The best effects of all kinds of this earth are on grass—and the grasses most benefited by far are the clovers. Potatoes, both sweet and round, and buckwheat are also greatly improved. In cases where there was scarcely any clover on the meadows, after this earth was applied, red clover so increased without seeding as to cover the land. And where red clover does not come, white clover does. These effects are so remarkable, that some intelligent and generally well-informed persons have not been able to avoid the belief that these plants were produced without seed, merely by the operation of the green-sand earth. B. Whitall, however, thinks that the clouds of sand which are sometimes blown by high winds in dry weather, may well convey the seeds of clover from the high lands to the meadows.

Minimum effects of this manure have been already sufficiently presented, though merely in general terms, when referring to classes of cases in which these earths were either very nearly or totally inert and worthless. A few other cases of *maximum* benefits will be here stated.

On the farm of Joseph Whitall, a piece of the low land, in its poorest and most unproductive state, was dressed with 12 to 15 loads (240 to 300 bushels) of purchased green-sand earth of best kind. The land had been standing in grass, as all such land is kept generally, and for as many years together as grass remains worth mowing, or furnishes good pasture. But the really good grass here would have scarcely furnished 100 lbs. of hay to the acre, the general growth being very little except Indian grass, which is our broom grass. In the next season, clover had nearly taken possession of the ground, and the crop of hay

was estimated at 1½ tons (3000 lbs.) to the acre; which rose to 2 tons the next summer, and to 3 tons on the third season. One mowing only is taken in a year, after which the grass is pastured. A neighboring farmer, named Chew, whose farm was among those I saw, about six years ago purchased his land, then in very poor condition. The first year his supply of grass could not graze and fodder, and that badly, but two or three horses and six or eight cows. Two years ago he mowed 100 tons of good hay, and might have mowed 50 more. He had applied the green-sand earth rapidly and heavily. Though purchased from his neighbor's pits, the distance was small. He applied generally more that 200 bushels, and sometimes he gave as much as 50 tons or wagon loads, making 1000 bushels to the acre. The present general appearance of fertility of his land answers to the report of the great improvement made.

Another farmer bought a farm in the worst and poorest condition at $9 the acre, which price is held here to be extremely low. (Good land, or such as is well improved by this mode, will sell for $100 the acre.) In four years after his first application of this earth, he rented out 6 acres of the ground so improved, to another person for $150, for the raising of a single crop of sweet potatoes. And the tenant, after paying this rent, and all other expenses of tillage, &c., would have cleared $300 by his crop, if he had sold in the fall; but choosing to keep his potatoes through winter, he lost a large portion by their rotting.

With such particular facts of remarkable improvements and profits from particular applications of this earth, I might fill more space than this whole article ought to occupy. The general appearance of improvement, pointed out to me on the many farms I rode by and through, contrasted with other, and sometimes with the immediately adjoining natural and poor land, was abundantly convincing and satisfactory as to general results. And in many cases, the lines of separation, where the last dressing stopped, were seen, showing as great and as striking difference as are produced by the best effects of the calcareous marl of lower Virginia—or say from double to quadruple the products of the unimproved ground.

But it should be remembered that it has been only by long and varied trials of different kinds of green-sand earths, and on different soils and under different circumstances—and not without numerous early failures and heavy losses, that the farmers have arrived at their present degree of certainty as to deriving sure and profitable effects from particular modes of application. And even now, after such long use, my experienced and intelligent informants state that the only safe way in beginning new operations, is to try a small quantity of each available variety of earth, upon every different variety of soil designed to be dressed, and to wait for the results of these experiments to direct which manure to use, and where to apply it. The necessity of the case has had the good effect of inducing almost every farmer to be a careful experimenter; and has caused more knowledge to be thus gained, than is usual by such means. Still, I repeat, all these numerous experiments, and the long and varied general operations, have not made known any thing of the mysterious cause and manner of action of this manure, nor even enabled any safe general rules to be formed for new operations.

The price paid for the green-sand earth is the smallest part of the expense. The distances to which it is hauled are such as would astonish the most zealous marlers of Virginia. If not exceeding two miles, the distance is deemed of no account. The greater number probably haul more than four miles. In Burlington county, the greatest distance heard of to which it was known to be wagoned, as a regular business was nine miles; in Gloucester fourteen miles, and elsewhere it has been wagoned more than fifteen miles. Most of this work is done in winter, when, as the farmers say, they could do little else. My two companions, who haul four and five miles, make but two loads a day with a team; and many regular and well satisfied operators can make but one load a day, with a good team. The varying but always enormous expenses may be thence computed. Yet, though these improving farmers are numerous, it should not be inferred that all are so. Many make little or no use of this manure; and of these, some are the nearest neighbors to the diggings.

Caustic stone lime is used by the best farmers in Gloucester, who also use the green-sand earth, and sometimes the two manures are mixed together before being applied, under the belief that the effect of each is thereby increased. The farmers suppose that both produce different and independent benefits to the land, no matter which may be the first or the last applied.

But the effects of lime must be small compared to other and usual cases. Josiah Tatum, while farming in this neighborhood, applied some thousands of bushels of lime as manure, at various times, and does not think that more than a tenth of the quantity applied was really profitable. He found most benefit from lime on good medium soils, such as the sloping margins of former ponds, on which lime did better than on the stiffer land below, now drained, or the more sandy, lying higher. Joseph Whitall has used lime at different times for 25 years, and is doubtful whether the whole profit has more than paid the whole expense.

Gypsum is also used by many, and advantageously, and is supposed not to be influenced in its effect by the previous application of the green-sand earth. Gypsum acts best on the high and light land, on clover, less as approaching the most sandy, and not at all on the lower land or "quicksandy bottoms." Even where acting, J. Tatum deemed its effects as uncertain as the weather. If no rain fell for two weeks or more after sowing the gypsum, (a bushel to the acre,) it rarely acted that year; and whether acting or not the first year, no benefit from it is expected to last through the second, or to show in any subsequent season.

After a detention of some days in Philadelphia, which was not altogether fruitless as to the main object of my journey, I proceeded to examine another and a much more improved and important district of New Jersey. This is the country surrounding and neighboring to Woodstown, in Salem county. To see and learn by inquiry more of the soil and country, I travelled by stage coach, disagreeable as that mode was over the deep sandy roads of Gloucester, and in very dry and dusty weather. The steam-boat to Salem offered

a much more pleasant and rapid conveyance. Even to my transient and hasty, as well as first view of this line of travel, there was much to yield interest and information on the general agriculture of the country; but I must confine my remarks to the use of green-sand earth, and matters connected either nearly or remotely with that mode of improvement.

Except where varied by the meadows and pastures near Philadelphia and the Delaware, reclaimed from the tide, (and mostly appearing to be very imperfectly reclaimed,) the road passed, for more than twenty miles, as far as Gloucester county reached, through very sandy lands, showing, however, considerable differences of quality and variety of surface. The level white sandy lands, from Camden to the beginning of the green-sand region, in any other locality would be deemed almost worthless. But being supplied almost annually with putrescent manures from Philadelphia, and cultivated in crops of garden vegetables for that market, these deep sands are kept both productive and profitable. If limed throughout, and then dressed with the green-sand of the neighboring region, no doubt the putrescent manures would last much longer, and the lands be far more productive. The non-use of the green-sand earth, where other manures are used in such great quantities and at great expense, would seem to indicate the opinion of the unfitness of this soil to be benefited by this earth. The peculiar face of the country and soil about Woodbury, with the alternations of sandy knolls or low ridges, and shallow basins or hollows of wet, oozy land, were described in the former part of these remarks. This kind of land did not extend many miles south of Woodbury, and the wet basins disappeared, and all the soil was dry and sandy, and becoming more undulating in surface. Still, though much of very poor land was seen here and elsewhere, no where in New Jersey did I have an opportunity of seeing the poorest grade, so celebrated as "barren sands of Jersey;" nor even any naturally pine-bearing lands. About Swedesborough, the sandy lands approached to a reddish hue, and are of much better quality, and said to be much more retentive of putrescent manures. Approaching still nearer to Woodstown, and indeed generally throughout Salem county, the soil is seldom too sandy, but varies from medium loam to clay loam. Throughout the route from Woodbury to Oldman's creek, (the dividing line of the two counties,) here and there, though but sparsely, were seen improvements made by the green-sand earth, and which were especially evidenced by good clover standing on soil that seemed too sandy to bear it at all, even if aided by all that lime and putrescent manures alone can do for such land. But it was not until I reached the neighborhood of Woodstown that these valuable improvements of land became general.

Here again I had occasion to congratulate myself as to the hands into which I fell. My first used direction led me to David M. Davis, a resident of the village, and his kind attentions and hospitality left me nothing to desire, either as to the means for obtaining the best information, or for any other accommodation and comfort that his house and other means so abundantly afforded. In addition to all that he could tell and show me of his own operations, he carried me to as many of the most interesting points for observation as could be visited during my short stay, and enabled me to see and to inquire of many of the farmers most experienced in the use of green-sand earth.

He had not been a farmer more than a few years, and for the last seven has rented out his principal landed property, and is engaged personally in mercantile business. Such changes in lower Virginia, or in any way placing farms in the hands of tenants, would be certainly ruinous to the land, and greatly injurious to the interests of the owner. But not so here. Self-interest directs to tenants a different course. And in this case, the improvements which had been commenced and well prosecuted by the proprietor in person, have been since well carried on, and nearly to completion, by his tenants. Though few persons have done better in improving land and crops and income, by using this manure, and few probably could have given me more full or correct information on this branch of agricultural practice, still Mr. Davis modestly disclaimed all pretension to the qualifications and merit of a good farmer, or one having general agricultural knowledge, and desired that disclaimer to be made to bear on all the opinions that he might state in answer to my inquiries.

Our first visit was to the diggings in Woodstown. These, though forming several properties, may be considered as a single locality, all being close together, and the difference of distance being no object to the purchaser. I found a wagon and team of six fine mules just leaving the diggings, with a load of 40 bushels of the earth. The driver informed me that the farm to which he was regularly carrying the earth was distant seven miles, and that he made three loads in two days. The farmer by whom he was employed had several other smaller teams also at work, and for a long time before, drawing the earth to his different farms; but wishing to get on faster, he had lately added this wagon and team to the hauling force.

These Woodstown diggings extend over three or four acres, all of which space has been excavated, and the green-sand earth removed. There was no digging then going on there, but plentiful signs of the extent of recent work in many large heaps, or mounds of conical shape, formed of the excavated earth, standing to dry somewhat, or wait until their different owners, who had either dug them or bought them of the laborers, should find it convenient to haul the earth to their farms. This green-sand earth was the first used in this neighborhood, and is the most highly esteemed; though it may well be doubted whether that opinion is not erroneous, and founded merely on the effects being longer and more generally known.

At Jonathan Cawley's diggings, near a mile distant from the last, laborers were then excavating. With a view of presenting actual and precise facts, rather than conjecture or general statements, I asked him to inform me how many farmers were then drawing earth from his diggings, and the distances to their several farms. This he did at leisure, and afterwards sent me a memorandum of the following statement:

4 teams were hauling green-sand earth to distances from	- - - -	12 to 13 miles
6 from	- - - - -	6 to 8 miles

6 from - - - - - - 4 to 5 miles
8 to 10 from - - - - - 1 to 3 miles

From this statement of actual distances, which probably does not vary materially from what is usual at other times and other diggings, the reader may perhaps form a more definite opinion of the high appreciation of this manure, and its extensive use, than from any merely general statements.

At another locality, visited next morning, there was a scene of much greater activity seen in numerous laborers employed in every different operation of the business. This locality embraced the several adjoining diggings of Richmond Dickenson, Henry Allen, and Allen Wallace. It was indeed a busy and spirit-stirring scene; and the operations were so interesting to those engaged at work, and to me as a spectator, that I should have been glad to have spent some days there for the mere gratification thus derived, and for full opportunity of conversing freely with the industrious and zealous operators.

The proprietor of a bed sometimes digs and sells the green-sand by the load; but the more usual course is to sell it by the square rod (16½ feet square,) to laborers, who uncover the earth, dig it out, and place it in a single high mound just far enough from the pit to be safe, and then sell by the heap to the neighboring farmers. The price by the load from such mounds is 50 cents, at the Woodstown diggings and other beds of highest reputation, and 40 cents at others, (as Cawley's,) which, even if as good, have yet to be as well established in the estimation of the farmers. However, as the quantity in a heap, yielded from one pit, is estimated with considerable accuracy, the sales are generally made by the entire heap, at a somewhat less price, say 40 cents the load, by the estimate of the heap. The covering earth is thick, say usually varying from 8 to 12 feet; and one place seemed to me 16 feet. This the laborers or purchasers by the rod have to dig off, and all down to the manure that is not used to fill the adjoining and last made pit, must be removed in carts some 50 or more yards. The excavation of the green-sand earth is never begun except in the morning, and by a sufficient force to sink it as deep as can be done in the course of the day. When sunk some 10 feet in the best earth, the increase of water, and the liability of the sides to cave in, usually compel the work to be stopped, and all below that depth is lost. The proprietor sells the privilege of digging at $6, $8 or $10 the rod, according to the greater or less difficulty of the work, or the less or greater amount of good earth to be obtained. In some cases (in Gloucester,) where there was very little covering earth to be removed, the price has been as high as $16 the rod. It usually requires 16 able men to dig out a rod in a day, and heap the earth excavated. A job which I saw in operation had 23 hands, 3 of them being boys; but this was unusually troublesome. Men hired to dig in the pits, are paid 75 cents a day if found in food, or $1 or 1.12½ if finding themselves. It is heavy labor, and the greater part is performed in mud and water.

Those who are accustomed to work in or to purchase the green-sand earth, recognize shades of difference in appearance and of value, between almost every two properties. But it would be useless and tedious in this place to pretend to make such discrimination. The general appearance of the best earth of each digging, which is always the lowest and much the thickest stratum, is very much such as Marshall's and Heritage's in Gloucester, described in the former part of this article. Of the latter, however, I saw no pit then opened much below the upper part of the bottom stratum. Here, I saw them at depths of 8 feet and more. At this depth, the earth was of firmer texture than the higher part, and is supposed by the diggers and farmers to be not quite so good as the higher part, of looser or more granular texture. It is however soft enough quite through to be dug easily with spades. I observed that, as cut by the spades, the new surface was mostly left of a vivid green hue; but upon examining the lumps I found that this color was merely superficial, and caused by the spade cutting through the granules; and that when the same lumps were broken by hand instead of being cut, the fracture was as nearly black as is usual. The water oozed or flowed from veins rapidly into the pit, as is general at such depths, and the laborers were often standing mid-leg deep in mud. One man was continually employed in baling out the water, which, as worked up with the green-sand earth, by the digging and trampling, was of a dull green color mingled with whiter streaks from the admixture of clay. In fact, the water as baled out and flowing off had much the appearance and degree of fluidity that would be presented by an accidental and imperfect mixture of a bucket of green oil paint with a smaller portion of dull white or light gray color. The water remaining in the old pits, or flowing from them, deposites a copious precipitate of yellow oxide of iron.

Above this good green-sand earth, (or "gunpowder marl," or "*real* marl," as here termed,) there is generally a body of inferior quality, but which yet is bought at lower prices to be carried to the shorter distances. There is much variation of appearance in this general overlaying stratum, and as much difference of opinion in regard to different kinds. Sometimes, (as at Richmond Dickenson's diggings,) it was a brownish red, almost composed of what had been formerly shells (*gryphæa convexa*) but of which the carbonate of lime had been entirely substituted by red oxide of iron. Little or no green-sand granules visible—and almost nothing to indicate fertilizing qualities, unless it be oxide of iron alone. Still this sold at 25 cents the load, or half the price of the lower black stratum. Sometimes the upper cover is brown, and this I saw carried away in wagons along the roads at the distance of several miles from the pits. In other cases, what would appear to the eye, and also by the reported chemical analysis, to be pretty good green-sand earth, has been found worthless on trial, and is thrown away if an overlaying stratum necessary to be removed. Such is a gray layer at some pits; and a green layer at Cawley's; though the latter is just over the "callus," a very thin layer of stony hardness, which lies immediately over the lower and valuable deposite. This "callus" is a common accompaniment.

The heaps of green-sand earth when first thrown up from the pits appear black, or at least a very deep bluish black. After drying on the surface, the color is grayish or bluish green, and after long exposure, on the outer surface of some, the

earth becomes of a vivid green. This last is not liked, and the earths showing it most are thought not to be among the best. But I saw it first, and most distinctly, at Heritage's diggings in Gloucester, of which the manure is in high repute, and very rich in green-sand by the geologist's reported analysis. The many large conical heaps, of regular form and nearly equal size, but varying in color according to age from deep black to bright green, present to the eye a novel and striking display at each of the principal diggings.

There is another general if not universal accompaniment which particularly attracted my notice, as I had seen and appreciated the same at home in our green-sand earth. This is gypsum which is left on the surface in a white tasteless powder, like a dusting with coarse meal, on the outside of the drying heaps of earth. I learned that the workers and users of the earth, though not knowing what this white powder is, had formed the opinion that the appearance was most decided in the earths best for manure. It appeared to me more abundant on the heaps of Allen Wallace—though his pits have been but recently opened for sale, and the earth has not yet acquired so much credit as that of Woodstown and some other places. On part of Heritage's earth, uncovered, but not dug out, the exuding fluid gypsum had dried and formed a thin crust. I cannot but believe that this gypsum is an ingredient sufficiently abundant and general in most if not all of these earths, to add very considerably to the other and unknown causes of value as manure.

As all the diggings present the same general appearance, it would have been a waste of my limited time to visit and examine all even of those near to Woodstown. When about to leave the last one, I asked its proprietor, Allen Wallace, what was the number of farmers taking from his diggings this season. He said about 30 persons; and he supposed that the next proprietor, Henry Allen, was supplying about as many; and the next, Richmond Dickenson, furnished considerably more than either of them. I thence computed that the three, which are all close together, and forming what I count as one locality, are supplying this season about 100 different farmers. There are six localities of diggings in this neighborhood, all within a circle of six miles diameter, of which Woodstown is the centre; and all these are supplying green-sand earth largely. Add to this that there are sundry other diggings in this and the adjacent county of Gloucester, all in active operation, and some idea may be formed of the number of farms on which this improvement is now in progress. This evidence of very general appreciation would be enough to prove great value, even if the cost were less than half its actual amount.

Next, as to the cost of the improvement, as an indication of the value of the results. As has been stated, the price per load for the best kind and far greater quantity used, is from 37½ to 50 cents the load of 20 bushels by estimate, but more often not more than 18 bushels. And though many farmers buy by the heap, or dig for themselves, Mr. Davis thinks that there is not much difference between these and the first-named mode of purchase. I asked of Richmond Dickenson, what he supposed was the average distance to which all those persons hauled the manure now being taken from his extensive diggings. He answered, at first, 6 miles. Mr. Davis thought 5 miles nearer the mark, and upon more full consideration the estimate was fixed at 5 miles—Dickenson being confident that as many loads were carried from his diggings upwards of 5 miles, as there were to less than that distance. I asked the same question of A. Wallace, who supposed 7 miles to be the average distance of his then customers. This was an off-hand guess and probably made somewhat too high. Some persons from other pits have hauled as far as 15 miles. The estimate of average distance calculated from Cawley's particular statement of numbers of teams, and the distance to which each hauled, as stated above, is 5½ miles.

I heard it mentioned that some farmers have estimated that every load of good green-sand earth spread on their land, added $5 to its intrinsic or productive value; and when I referred to this, as an extravagant assertion, to Messrs. William Reeve and D. M. Davis, they both defended the position as correct, in the cases of best and most profitable known action of this manure. The reader may judge of this for himself, from the statements which I shall hereafter submit.

Here, as before in Gloucester, I found almost all persons with whom I conversed to be Quakers; and persons of that sect are so numerous, that even other persons fall into the habit of using their "plain language," as it is termed.

The general rotation of crops in this part of the country is, 1, corn, on sward or old grass land; 2, oats; 3, wheat, to which all the manure is applied in September, before sowing, and on which clover and timothy seeds are sown; 4, 5, the grass mowed and afterwards grazed; 6, pasture. The green-sand earth is generally given as top-dressing on clover, the autumn and winter after taking off wheat. The quantity of the green-sand earth applied is usually ten loads of a wagon and two horses, and when near and cheap enough, 12 or 15 loads are often applied. Every man would prefer to give more, but for the cost. Nearly all the persons of whom inquiries were made concurred in the opinion that the effects were permanent, so far as their experience or information extended; and most of them had personal experience of from 10 to 15 years. Still, second dressings are given, and in some farms the third dressings have been applied, and with new benefit at each repetition. Some few doubted the permanency of effect. Dr. Whitall, of Burlington county, informed me that it was supposed there that the effect lessened after three years.

As elsewhere, the best effects found here are on the clovers and buckwheats; the least on wheat. Wherever applied first for and just preceding the latter crop, very little if any benefit has been seen. On buckwheat the effects of the green-sand earth are very remarkable, and it is a general practice to apply it for that crop; and being done for this crop mostly by poor men, and on poor land, it is put at not more than five loads to the acre. On part of the very poor land bought by David M. Davis for $5 the acre, he applied the earth at the rate of 10 loads, for buckwheat. The land was in Indian grass (broom sedge) when ploughed up for the buckwheat. The crop made was sold at $1 the bushel, which is an unusually high price;

and the amount was enough to pay for the whole expense of applying green-sand earth, (bought and carted 5 miles,) the cultivating and securing the crop, and also the purchasing of the land itself. Mr. Wm. Reeve told me of an experiment made by a neighbor (on stiff land, worn very low) with green-sand earth, applied very thinly, and an equal quantity of drawn wood ashes, on adjoining ground. The next crop of clover was pretty good on the green-sand earth, and only a tuft here and there was large enough to strike the view on the ashed land. The value of drawn ashes as manure is universally admitted. They are brought in large quantities from Philadelphia, and sold at Salem wharf at 8 cents the bushel, and sometimes more.

Lime is used by some farmers about Woodstown, but not generally or extensively. I could not learn that its being beneficial or useless had any connexion with the fact that the green-sand earth had been previously applied, or not. Particular opinions were opposed on this point.

It is a general opinion that the use of green-sand earth "brings in sorrel," or causes its increase. And this increase is not merely such as the increased fertility of the land would cause, (as if manured by dung,) but it shows a special action of this earth to favor the growth of sorrel peculiarly. Yet it roots out and utterly destroys the growth of poverty grass, broom-sedge, and cinque-foil, which, as in lower Virginia, are the regular co-occupants with sorrel of the poorest acid soils. In Burlington county, the "bringing in sorrel" was so manifestly the effect of the green-sand earth, and so injurious to the clover crops, that the application was thereby discouraged, until it was found out that liming prevented the growth of sorrel.

As to gypsum, in connexion with or after green-sand earth, the accounts and opinions differed. Samuel Lippincott, a successful improver and good farmer, had formerly found it beneficial, but after long use the repetitions had no effect. This was before applying green-sand, which he has done since to great profit; but since the gypsum has no effect. Wm. Reeve, near Alloway's town, on the contrary, finds lime, green-sand earth and gypsum, successively and repeatedly applied on the same land, to act always, and each producing a special benefit which he would not expect from an increased quantity of either of the others. Richmond Dickenson had found gypsum beneficial before applying the green-sand earth, but of no effect afterwards.

Most persons thought that the green-sand earth, in very dry seasons, burnt and injured the crop. S. Lippincott thought that on this account he had once made not more than 5 bushels of corn to the acre, on ground that would otherwise have made 75 bushels, from its previous high improvement by the use of this earth. Others thought that it was only on gravelly and sandy soils (such as Lippincott's field was) that any such injury was produced. Nobody, however, would have objected to much heavier than the usual dressings because of the danger of such injury. Lippincott had repeated his applications, and in part had given a third manuring of this earth.

As to the soils to which this manuring earth is suitable, all persons of whom I heard in Salem agreed in the belief that it acted well on all soils fit for tillage, or grass land dry enough to make good meadow or pasture. On loams, and on the more clayey soils, (which two classes comprise nearly all the surface of Salem county,) the effect is best. It is supposed to be much less on the sandy lands. But the farmers about Woodstown do not agree in the opinion of those whom I conversed with in Gloucester, that the best green-sand earth is inert, or nearly so, on very sandy soils. Josiah Tatum had stated to me the same, as the opinion just before expressed to him, by E. Harris, an intelligent farmer of Burlington county, whose judgment and experience Tatum said were entitled to great respect. Mr. Harris dissented from this opinion of the Gloucester farmers, and thought that if they had fully and fairly tried this manure on their sandy lands, they would have thought differently.

On the most sandy and barren lands of New Jersey, which, though so extensive and well known in other parts, my route did not touch any where, it seemed to be generally agreed that the green-sand earth had not been of any value, or at least had not been found profitable in use. But even as to these worst soils, Mr. William Reeve thought that the green-sand earth was only inoperative just as any and every other manure would be found to be on such excessively open and sandy soils. Yet, according to the general and vague reports of the most wonderful improvements made by means of this earth as manure, it is on these very noted "sand barrens" that the alleged effects are usually located.

The lands of Pittsgrove township were mentioned to me, by several different persons, as furnishing the most uniform and extensive case of great improvement in Salem county. The soil is of different grades of loam, and generally of medium texture. The surface is generally undulating. The original quality, or degree of natural fertility, seemed to have been good, though not by any means rich. These also seem to have been the circumstances generally of all the lands I saw in this county, except those near to the town of Salem, which are quite level and very rich, now as well as naturally. The largest landed property of D. M. Davis lies in Pittsgrove township, and may serve as a sample of the former general condition, and the more recent changes. I will therefore state what I learned of this particular property. Twenty years ago and for some years after, this land rented for $100 a year; and after considerable improvement, and as late as seven years ago, the rent was only $300. There were formerly about 200 acres of arable land, regularly cultivated in turn, and reduced to the lowest state of exhaustion. Since, 125 acres more have been brought into cultivation, and 20 acres more added to the farm by purchase, at $5 the acre—which here is held to be as low a price, and indicating as worthless land, as $1 the acre would in lower Virginia. Mr. Davis' occupancy and the improvement by green-sand earth began ten years ago, and for the last seven years the land has been in the hands of two tenants, on leases of five years. The tenants were bound by contract to apply a certain amount of green-sand; but the obligation was superfluous, as they apply much more that their obligation requires. The tenant of the larger of the two farms was bound to apply 500

loads during his first lease. Before two years had passed he had applied 1000 loads, expecting to be amply repaid in the three next years of his occupancy. The supply is from Woodstown, and the distance 5 miles. The annual rent now paid on the two farms of about 345 acres, is $1125, and the value of the land annually increasing. The proprietor furnishes rails, or materials for fencing. But the tenants are not even supplied with fuel from the land, but purchase it elsewhere. I walked through these farms, and the appearance of the crops, and especially of the clover and pasture lands, and of the heavy bullocks fatted by grazing thereupon for market, served as abundant confirmation of all that was told me of the productiveness. There remained none of the land in its previous barren state to exhibit even a specimen; but some of the like was shown me elsewhere--and certainly none could appear more worthless and hopeless of yielding profit by being enriched. These arithmetical statements of increased net annual products, made principally by the improving labors of tenants, and by their voluntary action, speak more strongly than could any expressions of mere opinion of the value and the profit made of this manure.

In company with Mr. Davis, and upon his suggestion, I visited still another and more remarkable scene of agricultural improvement. He had told me that there were to be seen on the land occupied by Mr. William Reeve, some of the best evidences of good farming and successful improvements by, or in connexion with, the use of green-sand earth. This farm lies adjoining the village of Alloways town, and consists now of 200 acres of farming land, or the entire extent of fields for tillage and grass. The surface is more undulating than usual, but not too uneven or hilly. The soil of the farm (as of its neighborhood generally,) is stiffer than any other part of the county before seen, being a pale yellow clay, which is stiff enough to be difficult to till, and to form cracks in the surface in dry weather. By the way, it may be not amiss to mention that I saw no sign of red clay soil or sub-soil, on my whole route in New Jersey. The present growth of the farm, which is mostly clover, shows every where within the general enclosure, high productiveness and beautiful farming condition. Yet a part without the enclosure seemed to be a specimen of as barren and worthless land as I ever saw, that was capable of producing any vegetation. It had formerly been cultivated and worn out, and had long been left out of tillage. It had a few scattering bushes, and a general but thin and low growth of broom sedge. Cinque-foil and mouse-ear were also plenty, all these plants being deemed the strongest evidences of barren land. Some spots could not even bear either of these—but its otherwise bare surface was covered with a thin and hard gray crust, which seems to have no life, but which in fact is a kind of moss, indicative of next to absolute sterility. These several marks reached generally to the very fence, and when on the other side, and but a few inches distant, clover and other growths of fertile ground showed clearly that the hand of the farmer, and that but recently, had caused this striking difference of condition. Thirty acres here had been bought for $4.50 the acre. Such as is this outer and waste land, Mr. Reeve assured me was the condition of much the greater part of the farm ten years ago when the estate was purchased, and the improvement of the land was first begun. Some of it indeed was much worse. For all the steeper declivities, such as were pointed out to me, then green with thickly set clover and other grasses, were formerly naked galls.

As explanatory of and introductory to the farming operations, I will mention some circumstances which I heard from other sources, and which it is proper I should so state, lest it might be supposed that I had them from one of the parties concerned. Of these, I saw Mr. William Reeve only, and all that I asked of or heard from him was in regard to the farming operations, of which he is the sole director. The whole property and business are much larger. Besides the farm, there is a large milling business, for sawing timber as well as grinding grain, and a vessel and boat-building yard. The property is owned jointly by three brothers, who severally manage the three different departments, and all of them in a manner which shows great energy, intelligence and good judgment, and successful results. The three brothers came from Burlington county, where the green-sand earth was first used, and has been longest and best known, and their father and uncle were among the early improvers.* The varied and yet combined operations of these brothers have been ably conducted—and they have had a marked effect in improving the operations of their whole neighborhood, by their example and by the many indirect modes by which every such individual influences the conduct and well-being of all around him. Every such man, in any honest and useful exercise of industry, but more especially as an improver and cultivator of the soil, is a blessing and a source of profit to all his neighbors and to his country at large. And every such farmer as I take William Reeve to be, is worth more to the community among whom he labors, than would be ten-fold the amount of all his property if distributed among them.

To sustain the teams necessary for their milling business, and transportation of their timber, it was difficult to procure hay in so barren a district. This want was a main inducement to go to farming and to improving. To commence this, on such land, was of itself matter of surprise to the neighborhood, which was heightened to wonder and to ridicule, when among the first commenced operations, were the purchase and application of 1000 bushels of lime.

The first year of their farming, 1833, the whole land was first under one general enclosure, and all the grass was mowed that could be possibly obtained, as hay was the most important object. The whole product was 5 tons only. In reply to some of the jocular taunts and predictions of their neighbors, Mr. Reeve offered to bet that he would double the first year's product of hay every year, until the amount reached 100 tons from a single mowing. In seven years, the crop amounted to 225 tons, besides the then keeping a fine stock of grazing cattle, and the regular tillage of grain crops.

* Mark Reeve, the uncle, was the person whose opinions were referred to as authority by Judge Peters, in a passage quoted in my account of the "gypseous earth of James river," Farmers' Register, vol. i. p. 211

The earliest operations of tillage and improving (in 1833) was to plough 12 acres in the spring, apply stone lime at 50 bushels the acre, and cultivate in corn. The next year oats. Both crops were very good for the land. Again 50 bushels of lime were applied to the acre; and before the wheat, which was the next crop, barn-yard manure was given at the rate of 10 two-horse loads to the acre. Timothy seed sown with the wheat, and clover in the spring. The next winter, after the wheat crop, applied green-sand earth, 10 tons to the acre, hauled 7 miles from Woodstown. The crop of hay was 2½ tons to the acre; and its value was enough to pay for the whole expense of all the lime applied, charged at the cost when landed on the wharf, and that of the purchase and wagoning and spreading of the green-sand earth. This year, a neighbor offered Mr. Reeve $24 for the grass then standing on a single acre, which was refused; and he sold the grass of half an acre for $15, or at the rate of $30 the acre. This mode of purchasing grass, to be mowed and cured by the purchaser, is not uncommon hereabout. Only one mowing of grass is taken, and the grass is grazed the balance of the year, but not closely. Like his countymen generally, Mr. Reeve's rotation is 1, corn, 2, oats, 3, wheat, 4, 5 and 6, clover and timothy, for hay and grazing. But he does not limit the duration of the grass to three years, but lets it stand as long as the grass continues good, he being confident that the land improves every year it is so kept, though mowed once, and afterwards grazed moderately. He has land yet in grass that has been so for seven years, and the clover not yet near run out. In addition to green-sand earth, and the double liming, (and he means yet to lime again, and at 75 bushels for the third application,) he sows a bushel of gypsum every spring on all the clover land; and he finds distinct and remunerating benefit from each kind of manure, and from every application. He does not think that the increasing of one or two of the three kinds would supersede the necessity of the other manure. The green-sand earth, he thinks, thickens the coat of grass, and covers with it every part of the surface, more completely than the lime or the gypsum can do, either separately and alone, or together.

While looking at these improvements and hearing the details of labor, expenses and returns, it occurred to me, as it has perhaps already to my readers, the ready objection to be made—and soon after I heard it adduced. This objection is, that with the Messrs. Reeve, the fertilizing of poor land and making heavy crops is but a matter of expense in money, and that, without such means, over and above what their farm could alone supply, these improvements could not be made. That might well be; or at least the progress of improvement would be necessarily much slower, if without any disposable capital for improvement. But, however opposed to general opinion, I maintain that nothing is so infallible a test of the value of agricultural improvements, as when they are paid for in money by a judicious and well-managing capitalist and man of good business sense and habits. Such men do not advance or expend their money except for profit; and from all that I saw and heard of the character and habits of Mr. Reeve, I should rely implicitly that he would not long pursue a system of farming which he did not find to be profitable.

This farm is without the limit of the region of green-sand earth, and it cannot be had of good quality short of seven miles. Moreover, there is no leisure to haul it, except during winter, and the deep and wet clay soil then renders it impossible, except when the road is made firm by freezing. Hence this mode of manuring is slower than others; but it is designed to be pushed on every winter, as fast as possible, until all the farm has been covered, or as long as it shall be deemed necessary to repeat the dressings. This, considering the peculiar difficulties, and the careful estimates of cost and returns upon which the practice is based, and the greater ease of procuring lime and gypsum, and their excellent effects not being deemed a substitute for the green-sand earth, all serve to present, in a new and striking point of view, the peculiar and great value of the latter manure. Mr. Reeve knows of no land where the green-sand earth has been applied and found useless.

Among the many reports I had heard in advance, were conflicting statements of the effects of this earth on the naturally rich and very productive lands around the town of Salem. While some affirmed the benefit, others stated that the use of green-sand earth had been there discontinued. I had but little time left for inquiry on this head; but that little was enough to show that both reports were true. Enough applications of this earth had been made on these good lands, to show very good effects; but the distance to the nearest diggings was so great, and the supply of water-borne lime and drawn ashes so much cheaper and more convenient, that the use of the latter manures had nearly or entirely superseded the former.

The lime used here is brought from the Schuylkill, the quarries being about Norristown, Pa., and though, varying in different parts of the limestone, the whole is highly magnesian. It is this same lime which is now brought, (by vessels which come for cargoes of wood,) ready slaked, in large quantities into James river, and sold to the farmers at 8, 9, and, at highest, 10 cents the bushel. Here, in Salem creek, and so much nearer the kilns, it is never obtained at less than 10 cents, was not long since at 15, and at first was 20 cents the bushel; and then, as now, readily bought by the farmers for manure. A short time since, a friend of mine, who had bought a vessel load of this lime, and fearing danger from the magnesia suspected to be contained, brought to me a small sample, in the then partially carbonated state, to be analyzed. The operation was roughly performed by a member of my family, and the result showed 37 per cent. of magnesia. The appearance of so large and unlooked an amount alone caused me to doubt the accuracy of the process. But I no longer doubt it, as these limes have often as much admixture of magnesia, and sometimes have more than 40 per cent. Of the limestones of two of the principal quarries in Delaware, used largely and advantageously for manure, the respective proportions of carbonate of magnesia (of Jeanes' quarry) are 46 parts in the 100 of limestone, and (of Klair's) 44 per cent. These statements are reported by J. C. Booth, esq., an excellent and accurate chemist, in his 'Memoir of the Geological Survey of Delaware,'

which he made by order of that state. All the stone limes which have been longest and most largely used for manuring in Pennsylvania, and which have produced so much fertilization and profit, have been highly magnesian. So our James river farmers need not hesitate about profiting by their present cheap supply, nor fear danger from this large admixture of magnesia in the Schuylkill stone lime, when applied in their usual moderate quantities of 36 or 40 bushels (slaked) at one dressing. In New Jersey I heard of 75 and 100 bushels being used without suspicion of their being danger from magnesia; and probably most of those who applied it had no knowledge of the presence of magnesia.

I have aimed throughout this inquiry to obtain and present the opinions of others, rather than to give my own views most prominency. And when the most experienced and well-informed practical improvers differ so much on this subject, it could not be expected that my hasty digest of their opinions should be entirely free from contradictions. In truth, my own opinions have not remained the same, at different scenes of this hasty examination, nor even during the writing of both the earlier and the latter part of this account. While I have learned much as to the effects and value of this manuring earth, by my inquiries and personal examination, I have at the same time also learned that I was before, and still am, profoundly ignorant of the cause and manner of the action. I will not even presume to attempt any explanation of what appears to me so far inexplicable by any of the views yet set forth.

There seem to be important differences of action between the green-sand of New Jersey and that of James river. It is true that the latter has been usually applied by myself in very small doses, say 20 to 40 bushels the acre, while in New Jersey the quantity is usually 200 bushels and often much more. But even this great difference of quantity does not at all serve to explain the differences of results—nor do the manifest differences of the different earths, or of the soils of the different regions. So far as my practical experience has extended, the green-sand earth of James river acts precisely as does gypsum, though more strongly—is limited to the same soils, to the same crops, and like gypsum has but a temporary though more extended limit of time of action. But the green-sand earth of New Jersey while agreeing greatly with that of James river in its visible effects (epecially on clover,) seems to act on nearly all soils, on most crops, and is counted as a very long enduring if not indeed a permanent fertilizer.

All the best green-sand earths which I saw, contain no carbonate of lime, or at most and in very few cases, so small a proportion as to be of no appreciable effect. They contain (according to Prof. H. D. Rogers' statements of their contents) from 85 to 95 parts of green-sand in the 100 of earth; and the pure green-sand (or silicate of iron and pot-ash) contains from 5 to 14 per cent., or generally 9 or 10 per cent. of potash. Since the discovery of this latter ingredient was made by Henry Seybert, esq., of Philadelphia, it has been generally supposed to be the main if not the sole fertilizing ingredient. I deem that opinion extremely questionable; and, as to the green-sand earth of James river, altogether untenable. But I will not here repeat the grounds of this opinion.

The gypsum, which is certainly present in most if not all the green-sand earth of New Jersey, has not been considered by the highest authorities as being an important ingredient. Indeed it does not appear among the contents in the many analyses stated in Prof. H. D. Rogers' Report. Without claiming for it any very important agency, still it seems to me that the gypsum cannot be of so little amount or effect, as has thus been assumed. And sulphate of iron (copperas) and sulphate of alumine (alum,) which are present in some cases, need only to meet lime in the soil, or to have lime previously mixed with the green-sand earth, to form still more gypsum, by the decomposition and destruction of either or both these salts, which are poisonous to soil and to vegetation.

The following statements of the composition of some of the bodies of green-sand earth referred to or described generally in this article, are copied from Prof. Rogers' 'Final Report' of his geological survey of New Jersey.

In Gloucester—Josiah Heritage's.

" *Composition.* In 100 parts.

Green-sand, - - -	93.70
Clay, - - - - -	6.30
Quartzose sand, - -	none.

" The proportion of potash in this marl, [forming a constituent part of the green-sand ingredient,] is 10.4 per cent."

Thomas Bee's.—" *Composition.* In 100 parts.

Green-sand, - - -	92.48
Clay, - - - - -	7.52
Quartzose sand - -	none.

" The amount of potash in this marl by absolute analysis is 10.35 per cent."

Salem county—John Dickenson (now Richmond Dickenson's)

" *Composition.* In 100 parts.

Green-sand, - - -	92.59
Clay, - - - - -	7.41
Quartzose - - -	none.

" The proportion of potash in this marl, by direct analysis, is 10.4 per cent."

Allen Wallace's—" *Composition.* In 100 parts.

Green-sand - - -	90.00
Clay - - - - -	8.00
Quartzose - - -	2.00

" The proportion of potash which this marl contains by analysis is 10.2 per cent."

Jonathan Cawley's—" *Composition.* In 100 parts.

Green-sand, - - -	86
Clay, - - - - -	14
Quartzose sand, - -	none.

" The proportion of potash which analysis shows in this marl is 10.3 per cent."

Jonathan Riley's (part of the Woodstown diggings.) " Composition in 100 parts:

Green-sand, - - -	88.28
Clay, - - - - -	11.72
Quartzose sand, - -	none.
Carbonate of lime, - -	a trace.

" The proportion of potash, as deduced from the green-sand, is 10.1 per cent."

James Smith's, Mannington Hill. " Composition, in 100 parts:

Green-sand, - - -	88.80
Clay, . - - - - -	10.20
Quartzose sand, - -	1.00

"The proportion of potash which this marl contains, by direct analysis, is 9.5 per cent."

All of these earths, as well as others, I saw in place, except James Smith's.

These stated contents, (as of a far greater number,) given in that report, are so nearly alike, that is difficult to believe that any difference of effects could be manifest from the difference of the amounts either of the green-sand or of the potash in the green-sand. Yet very different values are attached to the earths furnished at these localities. Heritage's in Gloucester is esteemed more highly than Bee's; and in Salem, the Woodstown earth (Riley's and Shinn's) is valued above all in the neighborhood; and James Smith's, after having been extensively used, has been abandoned as comparatively inert.

The upper light-colored green-sand earth at Mullica Hill, which, though not so rich as the best, yet contains 85 per cent. of pure green-sand and 5.50 per cent. of potash (according to the reported analysis) is pronounced by those persons who have used it for manure, to be utterly worthless. This is said to be the same green earth which I saw at Lippincott's, and also is cut through by the mail road on the hills on both sides of Oldman's creek, which makes the surface of the roads greenish, and rises to near the surface soil. Yet the soil, thus resting upon a green-sand earth, and necessarily more or less mixed with it, is very poor naturally, and shows no benefit whatever from its natural admixture with green-sand.

Also the stratum at Mullica Hill next below the one referred to in the first part of this paragraph is described in the geological report of Prof. Rogers as "a chocolate colored bed, in which about one half is the green granular matter [pure green-sand it is presumed the author means,] and one half a fine clay of a light purple or chocolate tint. This also has all the features of a good marl, though it is not reported to have any power." The want of power or feeble action as manure, of these several kinds of green-sand earth, are among the most remarkable of the many opposed and unaccountable facts which have been presented by the use of this earth.

USES OF CHARCOAL AS A MANURE.

From the American Agriculturist.

From an article on Dr. Liebig's Organic Chemistry applied to Agriculture, in the April number of the North American Review, it appears that the most valuable property of a soil is that of absorbing and giving off those vapors and gases that constitute so considerable a portion of the food of plants. Reflecting on this fact, it occurred to me, that charcoal might prove a most valuable manure; from its well known capacity of absorbing vapors, gases, and saline solutions, and under certain circumstances giving them out.

The ladies make use of charcoal in their flower-pots, from an experience of these results. At this time I did not know of its being used on a large scale. I communicated the idea to Mr. Phineas Sargent, and he remarked he did not know that it had been used as a manure; but that he had often observed the charcoal hearths were more productive than the surrounding land. I made further inquirers of Mr. A. B. Allen on the same point, and he had the kindness to furnish me Mr. J. H. Hepburn's valuable paper, "Charcoal as a manure," published in the Trans. of the Ag. Soc. of N. Y. p. 298, 1841. I was not a little gratified to find my speculations sustained by so accurate an observer.

As Mr. H. declined to enter into the chemical character of charcoal, I propose to supply that portion of the subject compiled from such writers as are within my reach.

From Ure's Dictionary of Chemistry, article Gas, we extract: "Of all solid bodies, charcoal is the most remarkable in its action on the gases. In M. De Saussure's experiment, the red hot charcoal was plunged under mercury, and introduced after it had become cool into the gas to be absorbed without ever coming into contact with the atmospherical air.

"One volume of charcoal made from boxwood absorbed of ammonia, - - 90 volumes.

Muriatic acid gas,	85	"
Sulphurous acid,	55	"
Sulphuretted hydrogen,	55	"
Nitrous oxide,	40	"
Carbonic acid,	35	"
Olefiant,	35	"
Carbonic oxide,	9.42	"
Oxygen,	9.25	"
Nitrogen,	7.5	"
Gas from moist charcoal,	5.0	"
Hydrogen,	1.75	"

"The absorption was not increased by allowing the charcoal to remain in contact with the gases after 24 hours, with the exception of oxygen, which goes on condensing for years in consequence of the slow formation and absorption carbonic acid gas. If the charcoal be moistened, the absorption of all those gases that have not a strong affinity for water is diminished. Thus boxwood, charcoal, cooled under mercury, and drenched to water, is capable of absorbing only 15 volumes of carbonic acid gas; although before being moistened, it could absorb 35 volumes of the same gas."

"Dry charcoal, saturated with any gas, gives out, on immersion in water, a quantity corresponding to the diminution of its absorbing power. When a piece of charcoal which is saturated with either oxygen, hydrogen, nitrogen, or carbonic acid gas, is put into another gas, it allows a portion of the first to escape, in order to absorb into its pores a portion of the second gas."

Charcoal, when reduced to powder, will absorb but half the quantity of gas that it would when in the lump.

The advantage of this article over every other that has been used as a manure is, that what is not actually consumed or washed away is retained on the soil, and will continue to absorb and give off the vapors, gases, and saline solutions for an unlimited period. It would therefore be an experiment worthy of trial by our western agriculturists, to make their wood into charcoal and spread it on the soil, rather than to reduce it to ashes, which at most will last but a few years.

C. H. RAYMOND.

Buffalo, Aug. 6th, 1842.

THE GEOLOGICAL HISTORY OF THE HORSE.

By Mr. W. C. Karkeek, V. S., Truro.

(From the Veterinarian.)

To trace the history of remote events, and to investigate the origin of our domesticated animals, has given occupation to the highest talents; and in this interesting inquiry, mouldering records, decaying monuments, fabulous legends, and the sibylline leaves of tradition, have yielded their respective tributes. But still the details, even of probable history, carry us back but a little way into the dark recesses of antiquity, and we soon reach the epoch when truth and fable are inseparably blended.

The natural historian and natural theologian have hitherto exclusively confined their attention to one volume of nature's history—that which relates to the present order of things; and man is regarded by them as the undisputed sovereign of the world around him—the cattle on a thousand hills are supposed to be at his disposal—the mighty deep yields its treasures to his skill—the savage denizens of the mountain and the forest are tributary to his power, and the *magna charta* for these vested rights they find in the inspired page. From the command to subdue the earth and to exercise dominion over its tenants, they draw the inference, that their only purpose was to increase his luxuries, and that they were created for no other use than that they might be subservient to his destructive propensities.

These views of the uses of the animal world, so long universally received, have been of late singularly modified by the light of modern science; for within the bowels of the earth the geologist has discovered a series of engravings, more or less injured and imperfect, yet all executed by the same hand, and bearing the manifest impress of the same mighty mind, which distinctly inform us of the characters and habits of races, some of them extinct and some still existing, which occupied its surface for many thousands of years ere man ever placed his foot on this wondrous soil, or contended with them for dominion.

To trace, then, the ancient history of the horse and his contemporary congeners, we must first take a slight glance at those engravings which have been discovered in the different strata of the earth, and which, like the brain of Touchstone, "is crammed with observation, the which it vents in mangled form."

Without embarrassing ourselves with the history of the geological epochs, we will briefly advert to a few facts—that certain families of organic remains are found pervading strata of every age, under nearly the same generic form which they present amongst existing organizations. Again, that other families, both of animals and vegetables, are limited to particular formations, there being certain points where entire groups ceased to exist, and were replaced by others of a different character. It is also a fact well to be acquainted with, that animals and vegetables of the lower classes prevailed chiefly at the commencement of organic life, and that the more perfect animals became more gradually abundant as the world grew older.

If we pass in succession from the ancient to the modern epoch—from the regions of sterility and desolation to that in which animal and vegetable life were profusely developed, we find that the first evidence of organic existence was, setting aside the infusoria, a few *fuci*, *mollusca*, and *polyparia*; these were followed by a large developement of the same order. In the succeeding period, reptiles and insects appear, with sauroid fishes, and an immense developement of vegetable life, particularly the cryptogamia class, such as mosses, ferns, &c. Large reptiles did not then prevail to an extraordinary degree at this epoch, in what are now the temperate regions of southern England, the weald of Sussex and Dorsetshire for example; but a very long time afterwards these spots were peopled by monsters of an extraordinary character, which stalked amid marshy forests of a luxuriant tropical vegetation, or floated on the genial waters. This state continued for a long period of time, when another change took place, and the country and its inhabitants were swept away. An ocean had usurped its place; and then after another long period of time, and the dry land had again appeared, it became covered with groves of forests, and herds of deer, and of oxen of enormous size. Groups of elephants, mastodons, horses, and other herbivorous animals, occupied its plains; its rivers and marshes were crowded with the hippopotamus, the tapir and rhinoceros; and its forests afforded shelter to the hyæna, the bear and the tiger.

This is the period when the horse first appeared on the stage of life, being the one subsequent to the last grand catastrophe, as it is frequently but incorrectly called, by which the earth was said to be overwhelmed,

"Ere Adam was, or Eve the apple ate."

We must now confine ourselves more closely to this particular period, being the one immediately antecedent to the present order of things.

In almost every part of the globe, beneath the present or modern alluvial soil, (which is a loose strata constantly deposited by streams and rivers,) extensive beds of gravel, clay, and loam, are found spread over the plains, or in the flanks of the mountain chain, or in the crest of ranges of low elevation: and in these accumulations of water-worn materials—termed by Dr. Buckland, *diluvium*, and by Cuvier, *alluvium*--are immense quantities of the bones of large mammalia. These remains belong principally to the mastodon and the elephant, to various species of hippopotamus and rhinoceros, to the horse, ox, deer, and many extinct genera; while in caverns and fissures of rocks, filled with calcareous breccia, the skeletons of tigers, boars, gigantic hyænas, and other carnivorous animals are imbedded. They have been found alike in the tropical plains of India, and in the frozen regions of Siberia, while there is no considerable district of Great Britain in which some traces of them do not occur. These remains are not always found together. Cuvier, whose authority I quote, says, that the *remains of the horse* have been found with the mastodon (an extinct animal allied to the elephant) in America; with the mastodon in Little Tartary, Siberia, Italy, and France; with the rhinoceros in France, Italy, and Germany; and with the rhinoceros, hippopotamus, hyæna, tiger, elephant, and a gigantic species of cervus, in Great Britain. Capt. W. S. Webb discovered the remains of the horse in a

fossil state, together with those of the deer and bear, in diluvium, and on the Himalayan mountains, at an elevation of 16,000 feet.

In South America the bones of horses of a large size have been discovered by Mr. Charles Darwin, naturalist to the Beagle, in company with the remains of the megatherium, of immense bulk, a huge mastodon, parts of rodents, and a llama fully as large as the camel.

"With regard to North America," Cuvier says, "the elephas primogenus has left thousands of its carcasses from Spain to the shores of Siberia." The fossil ox, in a like manner, he writes, is buried "dans toute la partie boréale des deux continens, puisque on en a d'Allemagne, d'Italie, de Prussie, de la Siberia occidentale et orientale, et de l'Amerique." "I may here add," says Darwin, "that horses' bones mingled with those of the mastodon, have several times been transmitted for sale from North America to England; but it has always been imagined, from the simple fact of their being horses' bones that they had been accidentally mingled with the fossils. Among the remains brought home by Captain Beechey from the west coast of the same continent, in the frozen region of 66° north, Dr. Buckland has described the astragalus, metacarpus, and metatarsus of the horse, which were associated with the remains of the elephas primogenus, and of the fossil ox. In Mr. Saull's Geological Museum, Aldersgate Street, London, there are three coffin bones, one os sacrum, and one cannon bone, from Big Bone Lock, Kentucky. In the same collection are one cervical vertebra, Herne Bay, Kent; several metatarsal, ditto, one dentata, ditto, and portions of two ribs, from Plumstead, Kent; several teeth from Banwell Cave, Somersetshire; and two teeth, and several astragalus, from Swansea, South Wales—all of the horse. With respect to Great Britain, as I before stated, there is no considerable district in which some traces of the fossil horse do not occur, in company with either those of the elephant, the rhinoceros, hippopotamus, tiger, ox, deer, or hyæna. At Oreston, near Plymouth, an immense number of bones of the rhinoceros and horse were found; and in a cave at Paveland, in Glamorganshire, those of the elephant, rhinoceros, horse, hog, bear, and hyæna, were found embedded together. In the celebrated Kirkdale Cave, Yorkshire, the contents of which have been so graphically described by Dr. Buckland, were discovered fossil bones of the tiger, bear, wolf, fox, weasel, elephant, rhinoceros, hippopotamus, horse, ox, and deer, and an immense number of the bones of the hyæna.

In the earlier ages, some of those colossal bones were supposed to belong to gigantic races of mankind, and hence the traditions of giants, possessed by every country in Europe; but it is an authenticated fact, acknowledged by all geologists, that no traces of man or his works have ever been discovered in any of the diluvium strata. Leibnitz, in his "Protogea," mentions the fossil bones of a unicorn, discovered at Quedlimbourg, in 1663. They were found in a calcareous and gypseous hill, and after being collected, a sketch was made of the animal, such as it was pretended to be; but a single glance at the sketch is sufficient to show that it was done by very ignorant hands, and taken after parts most incongruously joined. The bones of the horse seemed to have formed the principal part of the conformation, with a considerable portion of the muzzle, a piece of the humerus, a lower tooth, and an unguinal phalanx of the rhinoceros. It was supposed by Cuvier, but now denied by most of our eminent geologists, that the diluvium strata on which the animals we have described have been found embedded, was the consequence of a sudden inundation of water. It will be necessary briefly to allude to a few important facts connected with this subject, that are acknowledged by all parties:—First, that after all the strata which compose the crust of our globe had been formed, a great portion of the earth has been covered with water. Secondly, that the period or epoch which relates to this history was one of immense time, and that the whole surface was densely peopled by various orders of living creatures, some of them, as we have seen, not distinguishable from existing species. Thirdly, that great and considerable changes must have taken place since that epoch in the climate of different parts of the world; and confining our attention to our own island for an example of this, we find that there then flourished on its surface the luxurious vegetation of a tropical clime. In the course of time, however, the whole scene vanished, with various orders of living creatures then ranging the plain or swimming the lake, such as the tiger, the elephant, the rhinoceros, and the hippopotamus; while their contemporary congeners, as the horse, deer, ox, &c. were left behind. Shortly after this man appears on its surface.

When we carry our minds back to this subtertiary period—which, geologically speaking, is so recent that it may be considered as only just gone by—we receive the accounts with surprise and almost incredulity. It must be admitted, that they at first seem much more like the dreams of fiction and romance than the sober results of calm and deliberate investigation; but to those who will examine the evidence of facts, upon which the conclusions rest, there can remain no more reasonable doubt of the truth of what I have been relating than is felt by the antiquary who, finding the catacombs of Egypt stored with the mummies of men, apes, and crocodiles, concludes them to be the remains of mammalia and reptiles that have formed part of an ancient population on the banks of the Nile.

Now, if it was a sudden catastrophe or deluge which destroyed the hippopotamus, the tiger, and the elephant, how did the ox, deer, and horse continue to escape the flood of waters? Why this partial selection of its victims among the ancient inhabitants of our country? But these changes on our island are not more wonderful than the mutations that have occurred in other parts of the world. It is almost impossible to reflect, without the deepest astonishment, on the changes that have taken place on the continent of South America. Formerly it must have swarmed with great monsters, like the southern parts of Africa; but we now find only the tapir, guanaco, armadillo, and capybara—mere pigmies compared to the antecedent races. The greatest number, if not all, lived at the epoch we have been describing, and many of them were cotemporaries of the existing mollusca.

"In the Pampas," says Darwin, "the great sepulchre of such remains, there are no signs of violence, but on the contrary, of the most quiet and

scarcely sensible changes." "What shall we say," he continues, of the death of the now fossil horse? Did those plains fail in pasture, which afterwards were overrun by thousands and tens of thousands of the successors of the fresh stock introduced with the Spanish colonist?" "One is tempted," he continues, "to believe in such simple relations as variations of climate and food, or introduction of enemies, or the increased number of other species, as the cause of the succession of races. But it may be asked whether it is probable that any such cause could have been in action during the same epoch over the whole northern hemisphere, so as to destroy the *elephas primogenus* on the shores of Spain, on the plains of Siberia, and in northern America; and in like manner the *bos urus*, over a range of scarcely less extent? Did such changes put a period to the life of the *mastodon augustidens* and of the horse, both in Europe and on the eastern slope of the Cordillera in southern America? If they did, they must have been changes common to the whole world; such as a gradual refrigeration, whether from modification of physical geography, or from central cooling. But in this assumption, we have to struggle with the difficulty that these supposed changes, although scarcely sufficient to affect molluscous animals either in Europe or South America, yet destroyed many quadrupeds in regions now characterised by frigid, temperate and warm climates." The elephas primogenus is thus circumstanced, having been found in Yorkshire; and now associated (says Lyell) with recent shells in Siberia and in the warm regions of lat. 31°, in North America.

The law of the succession of types, although subject to some remarkable exceptions, must possess the highest interest to every philosophical naturalist. Some of the animals we have been describing appear to have been created with peculiar kinds of organization, suited to particular eras; and it does not seem extraordinary that their extinction, more than their creation, should exclusively depend on the nature (altered by physical changes) of their country. But as to the horse, for instance, his constitution appears suited to every climate; and we cannot account for their species being destroyed throughout the whole of the two continents of America, unless the change was much more considerable than we imagine it to have been.

It would seem, from what has been stated, that certain races of living beings and plants, suitable to peculiar conditions of the earth, were created, and when those states became no longer favorable for the continuance of such types or organization, according to the natural laws by which the conditions of their races were determined, they disappeared, and were succeeded by new forms.

The reader will observe, in the geological mutations we have briefly alluded to, that one simple inundation, one general catastrophe, is not sufficient to account for the phenomena we have described, since many alternate changes of heat and cold must have taken place to have produced these alterations on the earth's surface.

Mr. W. D. Saull, F. G. S., is the only writer who has accounted for those changes in a satisfactory manner. This gentleman confines himself principally to the strata of England, in his illustrations; but it will be seen that they easily solve all the difficulties that Darwin alludes to respecting these changes in the American continents.

Mr. Saull's elucidations proceed regularly from a fundamental principle as a basis, that the granite is the most ancient stratum, for on this all the other beds are successively deposited; and he is confirmed in this opinion by observations made in different parts of the earth, which tend to prove that such is the case. For not only in both Americas, but specimens have recently been brought from Australia, which exactly resemble the granites found in Devonshire, in Scotland, &c.

Having established a basis, he then proceeds to chemical analysis, which proves that this rock is composed of quartz, mica, and felspar, in the latter of which only is contained a small quantity of calcareous matter, probably not more than two or three per cent.; but that this is the germ, as it were, of production, of the shell, the fibre, and, ultimately, the bone, flesh, and food, so necessary for the support of organized beings when they come to be developed on the surface of our planet.

He then arrives at this conclusion,—that, by the action of water and the atmosphere, this hard substance is pulverized and decomposed, and in that state—when the circumstances are favorable, viz., under a tropical climate, and also saline waters—corallines would germinate from the root or basis before-mentioned: these being reduced to powder by the action of the element in which they grew, would in their turn, reproduce more, and thus the fertilizing principle would continue progressing; and so it is found on analyzation of all the primary rocks, which exhibit a gradual increase of this necessary material in the ascending order.

Now, as this material is found to germinate spontaneously, as it were, in hot climates only, the author deduces some original conclusions, which are of great value and importance, with reference to the effects on our planet.

1st. That matter and motion are universal, and that nothing whatever can be completely passive or at rest.

2d. That the revolution of a planetary body on its axis, and in its orbit round the sun as a primary body, being universal also, definite effects are thereby produced.

3d. That these effects are, *à priori*, light diffused, which light being atomical, although immeasurably minute, the excitation of the atoms being greatest where the recipient body revolves most rapidly, or traverses the greater medium in space, namely, the equatorial parts; hence it follows, as a necessary consequence, that the greater heat will be diffused on its central or equatorial zones, gradually decreasing towards both poles, where the motion of course is slower.

4th. That all parts of the earth's surface partake of the genial influence (so to speak) in regular successive order, requiring immense periods of time to accomplish it; and that our planet is, therefore, constantly and universally progressing, with reference to beings existing on its surface.

5th. That the elevation and depression of the oceanic waters in both hemispheres are also regular and constant, and most probably the effect of motion, although it may be distinct and subject to other laws than the changes of climate before alluded to.

6th. From these facts the conclusion naturally

follows,—that our planet is regularly changing its position, *en masse*, with reference to the centre of the system, the sun; that is, although polar axes will always exist, yet that their position cannot be constant, but variable, producing those great changes of position, and consequentiy of temperature—requiring periods of time almost beyond our calculations, but which, by astronomical investigation, will no doubt ultimately be established.

These are the principles on which Mr. Saull establishes his theory, and which he satisfactorily proves by examining the various strata of the earth. Through all the primitive rocks, from the granite up to the clay state inclusive, no organic remains are found—hence their term *protozoic*, that is, before life; but the calcareous matter has gone on increasing, and in the next stage, in what was heretofore called grauwacke, but now the upper silurian, we find life first developed in a few varieties of shell-fish only; other beds intervene, almost destitute of organic remains, succeeded by strata of great thickness, containing corals in abundance, and exhibiting for the first time, their masses in the form and pattern as they grew, with trilobites, orthroceratites, leptera, cyathrocrinites, orphis, euomphalus, &c. Abundance of other fossils are found in these beds, indicative of a tropical climate and the preponderance of saline waters.

Above this appears the old red sandstone, in some places upwards of 3000 feet thick, in which are no corals and but few fishes and shells, which he considers to be proof that a cold northern climate then prevailed, and the structure of this great formation shows it to be marine.

Above the old red sandstone is the mountain limestone, in which the abundance of what was animated life strikes us with astonishment. We discern, for the first time, the nautilus, with much larger orthoceratites than before, accompanied with spirifera, producta, bellerophon, crinoidea, with an immense number of corals, of innumerable varieties of species, and of the greatest beauty, the clear indications of a very hot climate, and also the prevalence of the oceanic waters.

Next in the ascending order is the millstone grit, the greater part of which is destitute of organic remains. Now, although this formation appears to be oceanic, yet there are many stems of vegetables found in it, which most probably, by some of the violent perturbations of the surface by volcanic or igneous action, have been forced into it, seeing that these stems of plants are all filled up with sea sand. A limestone bed succeeds, in which we trace scales, jaws, and teeth of many species of reptile fish, with marine or fucoid plants, which is considered by the author as a convincing proof of the gradual increasing heat of the climate during this period, and as preparing for the next most important epoch, namely, that of the great coal formation. Here it is evident that the oceanic waters had receded from the northern hemisphere, and the surface was covered with magnificent plants, with palms, palmacites, shrubs and arborescent ferns, with reeds in places of thirty or forty feet in height!—and it appears the atmosphere was replete with moisture as well as the surface of the earth. Baron Humboldt considers that at this period our climate resembled the hottest part of South America, whence some of the tributaries of the greatest river of the Amazons flows, which he graphically describes thus: Fresh water streams running in every direction; vegetation in places absolutely impenetrable; the moist, humid atmosphere producing rapid decomposition of the vegetation, and on the other hand forcing it like a hot-bed, so that some shrubs grow more than twenty feet high in one year: hence we naturally account for the vast quantity of bituminous coal, which is clearly proved to be of vegetable origin.

After this period the saline waters appear to preponderate, since the stems of the plants, &c., are all filled up with sea sand; and the proofs appear complete, that the temperature was gradually growing colder, since, in the next beds, the fossils are less numerous, but they clearly indicate their marine origin.

In the ascending order he now arrives at the new red sand-stone, and this he finds almost a repetition of the old red so much below it. In its sandy and frequently finely lamellated structure there is abundant proof of oceanic action and deposition. There are but very few fossils imbedded in it, yet small fossil fish are numerous towards the upper part of this bed: parts of the stems of trees are occasionally found, but they are completely filled up with silica. Now, as these could not have grown in the ocean, they must have become imbedded in this mass by other circumstances, probably volcanic action. The great masses of rock salt in this country are also found in this formation, which is a complete proof of its marine origin, and most probably those depositions and incrustations took place during the gradual decrease of the oceanic waters.

The author assumes that the temperature now increased in warmth, since in the lias formation, which succeeds the new red sand-stone, the remains of crocodiles, ichthyosaurus, and plesiosaurus, are found for the first time, with large nautilus; and ammonites of a great variety of species, with a vast abundance of fishes covered with scales, an infinite variety of shell fish, crustacea and testacea. Corals are also abundant in this bed.

Immediately above this, in the marlstone beds, he traces the impressions of plants, most of which resemble those of the southern tropics of the present day. Again, a change, and the oceanic waters preponderate. In the lower oolite the fossils are principally marine, and perhaps these lived under a colder clime; but the fossil remains are now so numerous and intermixed, that Mr. Saull cannot discover those broad and well-marked lines of distinction which he has so clearly pointed out heretofore.

The coral rag exhibits an amazing growth of corals, many of them of the species growing at the present day, in tropical seas. In the upper oolite he finds evidences of a warm climate, with its corresponding fossils; the most remarkable of which are those resembling the zamia or cycadeoidea of the present forests of Africa, with large fossil trees. Again, we arrive at fresh water and mixed beds, in one of which, the Wealden, are found the remains of the iguanodon, so admirably described by Dr. Mantell. This amphibious reptile must have been, when at full growth, not less than eighty feet in length. Mr. Saull's museum is rich in the number of bones it contains of this most extraordinary being. There are vertebræ

resembling those of a fish, more than eight inches in diameter; portions of the femur larger than those of the elephant of the present day; one immense claw, weighing nearly three pounds; and several pelvis, and metatarsal, and metacarpal bones, with many others.

In the green-sand, and in the gault, he is of opinion that the climate was again cooler; but in the next beds, the chalk, the temperature unquestionably was hot; the fossils and even the strata itself, being entirely of marine origin.

At the period of the London clay, he supposes the waters gradually retiring. Then all the valleys were tidal lakes, as evidenced by the remains, which consist of crocodile, nautilus, turtles, crustacea, and testacea; and as the hills were uncovered vegetation succeeded, consisting of plants, the seeds and fruits of which are analogous to those growing in much warmer latitudes than ours at the present day, perhaps resembling that of southern Africa. Thence he infers that the evidence bears out or supports the conclusions at which he arrives, namely, that with the decrease of the level of the waters, the heat of the climate increased, until in the succeeding period, when the first of mammalia, or hot-blooded animals, appeared; these are the palæotherium, anoplotherium, chiropotherium, lophiodon, &c., mostly resembling the tapir of the present day. Again a change: the ocean returned. Marine beings innumerable are found at this epoch, with the bones of the walrus and the whale. This in regular sequence again changed. The waters receded, and we then recognize that interesting period when the huge mastodon, the noble elephant, the rhinoceros, hippopotamus, hyena, tiger, boar, bear, wolf, deer, and horse, were the inhabitants of our now northern clime.*

I have already illustrated in this paper the change from this epoch to the present, in attempting to unravel the history of the horse.

The remarkable change of character in the British strata has for a long period attracted great attention with geologists; but no one has brought forward such an interesting and satisfactory theory as Mr. Saull. He considers also that, in astronomy, he has both an explanation and a proof of his views, that in the northern and southern hemispheres there is an alternate increase and diminution of the waters of the earth in successive periods of 25,800 years, being those of the precession of the equinoxes, and arising from the same cause; and he has satisfactorily established the proof of the changes of situation in the pole of the earth by a number of places, which have changed their latitude and longitude within the last 200 years.

It would be foreign to the subject to enter into the astronomical calculations by which Mr. Saull so easily solves enigmas that have for a long time embarrassed the geological world; for it must be confessed that they account for, and are fully equal to explain, all the geological phenomena—all the formations, all the variety of strata, all the fossil remains, and all those circumstances which are inexplicable without it.

The motions of the earth are still going on silently around us, like those that have passed; and the fair regions which we now inhabit must, in the regular course of nature, be covered again by the ocean. New layers of marine productions, of sand, gravel, and broken mountains, will overwhelm the soil to which we now feel such lively attachment; and, finally, new countries, or arrangements of land, will again rise in due course on those mundane sites which at present are occupied by civilized Europe, and by the northern parts of Asia and America.

For my own part, I see no moral evil to deplore in these changes. Nothing is effected abruptly, and man and animals are gradually warned to seek new habitations. The notices are slow, but unerring; and the human race will find fresh and renovated countries prepared for their subsistence and abundantly fitted for their enjoyment, by these grand operations.

I have already adduced sufficient evidence that the sea has covered the land at different periods; and any one who views the interior of our country must be sensible that its swelling hills and low valleys leading to the sea, must have been produced by the action of the oceanic waters. Volcanic agency from below has also produced many great and important changes in modifying and re-arranging the surface of the earth.

We will now endeavor to apply the knowledge we have obtained to investigate farther the ancient history of the horse.

Arabia has been frequently described by natural historians, from the very superior breed of horses found there from the earliest recorded times, to be the soil that gave birth to the primitive horse. I confess that at one period I entertained a similar opinion, and indulged my fancy-flight in imagining the first pair of horses located on some verdant plain in Arabia the Happy, and bearing a strong resemblance to the war horse described so emphatically in the Book of Job: "Hast thou given the horse strength? Hast thou clothed his neck with thunder? Canst thou make him afraid as a grasshopper. The glory of his nostrils is terrible. He paweth in the valley, and rejoiceth in his strength: he goeth forth to meet the armed men. He mocketh at fear, and is not affrighted; neither turneth he his back from the sword. The quiver rattleth against him, the glittering spear and the shield. He swalloweth the ground with fierceness and rage; neither believeth he that it is the sound of the trumpet. He sayeth among the trumpets, Ha, ha! and he smelleth the battle afar off, the thunder of the captains, and the shoutings."

This is a magnificent description of a war charger—but, splendid as it is, it will equally suit the horses harnessed to the war chariot of Queen Boadicea, which spread dismay and death in the breasts of the Roman legions, when Cæsar first invaded the shores of Britain. I do not by this remark mean to throw any doubt on the superiority of the Arabian breed of horses, but merely introduce it to show that Great Britain also possessed a very superior breed at this early period. We have already seen that they existed on our island long before man was created; and the probability is, that the breed which the ancient Briton then possessed were descendants of the olden race—modified greatly, of course, in conse-

* Mr. Saull's interesting museum, supposed to contain the largest private collection of fossil remains in the kingdom, is liberally opened to the public every Thursday morning, at 11 o'clock: no introduction whatever is required.

quence of the change of climate which had gradually taken place during an immense period of time. Whether the peninsula of Arabia possessed horses, at the epoch to which our history refers, which we are certain that our country did, we have not the means of clearly ascertaining; the probability is that she did not. We find Arabia to be an elevated table land, sloping on the north gently towards the Syrian desert, and encircled along the sea coast with a belt of flat sandy ground. The soil of this flat country, from its regular inclination towards the sea, as well as from the large beds of salt and marine exuviæ with which it is interspersed, appears to have been at no great geological period a part of the bed of the ocean. This flat country produces the principal pasturage, and contains rich groves of dates and other fruits. The interior of the country is chiefly burning sandy deserts, lying under a sky almost perpetually without clouds, and stretching into immense and boundless plains, where the eye meets nothing but the uniform horizon of a wild and dreary waste.

It is observed that the sea, particularly on its western coast, still continues to recede. The reefs of madrepore and coral which abound in the Arabian Gulf, and in some parts rise several fathoms above the sea, are increasing and coming nearer the shore. Thus this flat fertile part of the country is constantly extending its limits. Muza is mentioned by Arrian as a seaport of Arabia Felix; we now find it at a distance of several miles from the sea. In the southern part of the Arabian Gulf the sea is also receding from the land.

From these facts we come to the conclusion, that at the period when horses were freely ranging throughout the continent of Europe, the present flat fertile land of Arabia, if not the whole peninsula, was covered with sea; and it appears altogether absurd to suppose that nature would have placed her first-born pair of horses on such a desolate and sandy soil, even if it were not so.

That Great Britain was once connected with France there can scarcely be a doubt. The nature of the cliffs, similarity of strata, and other circumstances, sufficiently prove this; and all tends to increase the opinion, that Great Britain has as good a right to be considered as the primæval birth place of this noble animal as any other country on the globe. It is true, that the present state of our knowledge is not such as to warrant us in coming to any certainty on the subject, but on the whole, I consider it to be very probable.

The earliest historical account of the horse comes from Arabia. The author of the Book of Job is supposed by Dr. Hales to have lived 184 years before the birth of Abraham. The scene of the poem is laid in the land of Uz, which Bishop Lowth has shown to be Idumea. The Arabs also themselves trace the genealogy of their Nedjyds up to the time of Abraham; and when we consider the almost religious zeal with which the preservation of their pedigrees has ever been regarded, and the rigorous enactments which have been resorted to in order to preserve the purity of their breed, we certainly must give them some credit for their statement.

The Nedjyd breed, so serviceable in the cause of Islam, is supposed by the Arabs to have obtained, through Mahomet, the prophet of God, an occult capacity to read or repeat, tacitly, every day some verses of the Koran. It was one of their old proverbs—that, after man, the most eminent creature is the horse—the best employment is that of rearing it—the most delightful posture is that of sitting on its back—the most meritorious of domestic actions is that of feeding it; and they were taught by the prophet to believe that it was originally predestined for their special service.

LETTER FROM THE REV. J. H. TURNER.

For the Farmers' Register.

I thank the editor for his permission to reply to Mr. Peyton's last communication, but must respectfully decline it, especially as that gentleman is not allowed a similar privilege. In fact, there is nothing to reply to; for, except a long list of insulting epithets and coarse figures, which I do not choose to copy, there is nothing but a *second* edition of his former piece, to which I have already fully replied. Now all epithets and figures of this sort are ranked by me with planting beans in a *liquid*, and then succeeding these with corn plants—they are entirely out of my line. I beg leave, therefore, to refer all such matters to Mr. Peyton and his worthy associates, Macaire Prince and De Candolle. Chaptal is again excluded from the other Frenchmen, because I happen to know that he can be of no service in this thing.* In the mean time, if Mr. Peyton should think proper to issue a *third* edition, and I find it *improved* as well as *enlarged*, I will then with pleasure claim the privilege of a reply.

One other matter deserves a little notice. My "mammy," who, according to one of Mr. Peyton's chaste and elegant sentences, planted "successive crops of cotton in her cotton patch behind the kitchen chimney," and thus *practically* taught me that the same crop could be profitably reared on the same ground for many years, taught me also another important lesson, which I remember to this day; and that is, that if I ever did an injury, whether intentional or not, to any human being, that not only justice, but my *honor* was concerned, in making a becoming reparation. This good lesson I now propose to reduce to practice. Judging from the sprightliness of Mr. Peyton's imagination and the brilliancy of his fancy, traits not often associated with the soberness and mellowness of age, I did venture to conjecture that he was a *young* man. The gentleman, however seems piqued at the charge, and refers to his quondam schoolmates to prove that he was in existence at the very remote period of *twenty-five years ago*. I am therefore guilty of this unintentional injury, and, as the only reparation now in my power, I do hereby promise, that if I ever have occasion to speak of the gentleman again, I will do it under the appropriate title of *old* Mr. Peyton.

J. H. TURNER.

* If Liebig should again undertake to "modify" the matter of the beans, I think it would be well for him to extend his modification to the figures and epithets also.

ON ORGANIC MINERAL MANURES.

By Prof. Charles Sprengel, (translated from the German.)

From the Gardeners' Chronicle.

Under the name of organic mineral manures are comprised those materials which (as the name implies) are composed partly of organic remains and partly of mineral substances; thereto belong mould, mud, artificially prepared compost, rubbish collected in the streets, the soil of sinks, &c. These organic mineral manures are of great importance in agriculture.

1. *Mould.*—Mould is that kind of soil which occurs often in low lands, is very rich in humus, and at times contains some remains of plants. If the situation is not too damp, and if the higher grounds which surround it are composed of clay, argillaceous, marly, or calcareous substances, it generally possesses such superior qualities that it can be immediately carried and spread as manure, inasmuch as, under the circumstances just mentioned, it consists of a mixture of earths impregnated with humic acid and other materials strongly promoting vegetation. If, however, this mould is accumulated in wet places, and the surrounding heights are composed of sand, it is, generally speaking, of such an anomalous composition that it will spoil any ground on which it may be carried, unless it undergoes some previous preparation, because in this case it contains much protoxide of iron impregnated with humic acid, and is, at the same time, very deficient in the earths combined with that acid, as well as in the saline substances which constitute a most essential nutriment of plants. The value of every sort of mould depends (as is the case with all substances used as manures) on its component parts. If it is, therefore, intended to form at once an accurate idea of the effect which this manure will produce, it is to be subjected to an accurate chemical analysis; especially the organic remains containing nitrogen, are to be inquired into, inasmuch as its value will entirely depend upon their quantity. The generally received opinion, however, is, that any sort of mould is only so far useful as it supplies the soil with a greater quantity of humus. I have already analysed several sorts of mould which were used as manures, and for the sake of proving what I have just stated, I subjoin the analysis of a mould which came from a valley surrounded by sand-hills, and which, in its application, did not produce any considerable result.

100,000 parts of it are composed of—

52,910	"	silica and quartz.
31,269	"	humic acid.
10,200	"	coal of humus and vegetable remains.
2,312	"	alumine, combined partly with humic acid, but mostly with silica.
1,554	"	protoxide and oxide of iron, combined with humic and phosphoric acid.
0,044	"	protoxide of manganese partly combined with humic acid.
0,632	"	lime, mostly combined with sulphuric acid, but partly mixed with the coal of humus.
0,146	"	magnesia, partly combined with silica or mixed with the coal of humus.
0,870	"	sulphuric acid, partly combined with calcareous earth, partly mixed with coal of humus and vegetable remains.
0,045	"	phosphoric acid, combined with oxide of iron.
0,008	"	common salt.
0,010	"	potassa, mostly combined with silica, and traces of substances composed of nitrogen.
100,000 parts.		

If an approximate calculation is made of the quantity of humic acid which is combined with the bases (alumine, manganese and iron,) it will be seen, that this mould contains at least 15,000 parts of free humic acid, acting as such. To this is to be added, that it contained neither humate of lime, humate of potass or soda, nor any substance containing nitrogen; and another reason why it could not yield a good manure is, that it contained a quantity of humic protoxide of iron. This mould was, therefore, of very little use; so much so, that an additional quantity of common manure was required.

All those kinds of mould which are ascertained to possess superior manuring qualities and which are found in low places surrounded by clayey or argillaceous hills, are, on the other hand, composed of the following substances :—33 per cent. humic acid, 6 per cent. coal of humus, 9 p. c. alumina, 3 1-2 p. c. lime, 1-2 p. c. magnesia, 2 1-2 p. c. oxide of iron, 1-2 p. c. oxide of manganese, 42 p. c. silica and quartz or sand, 1-2 p. c. gypsum 3-4 p. c. phosphate of lime, 1-4 p. c. potash, 1-10 p. c. common salt, and 1 1-2 p. c. organic remains containing nitrogen. From the quantity of bases here, it is clear that such kinds of mould cannot contain any free humic acid; they consequently act very differently from the last. At times, good kinds of mould contain only 12-13 p. c. of humic acid, and 45-50 p. c. of sand.

It would be superfluous for me to detail again in what manner the humic acid of the mould is beneficial to vegetation, as this has been repeatedly stated on former occasions. If it contain organic remains composed of nitrogen, they form by their decomposition nitric acid, which then, combined with the different bases, forms saltpetre, possessing powerful manuring qualities.

Mould improves, chemically, all sorts of soil, even that richest in humus not excepted, because it contains generally from 50-60 p. c. mineral substances, amongst which are, as we have just seen, some very efficient ones. The mould, or the humus contained in it, renders a clayey soil more light, whilst a sandy soil is made thereby more firm and kept in a damp state. It is, consequently, especially adapted for soils that burn, in which it is often more efficacious than even dung. If the soil is light and sandy, you will make use of a mould somewhat clayey; if, on the contrary, the soil is clayey, a rather sandy mould is to be employed.

The length of time during which the effects of the mould may continue, cannot be easily determined, as it depends on its quality and the quantity used. Large quantities improve the soil after even 20 and more years, whilst small quantities act but for a comparatively short time.

Before the mould is ploughed in, it is to be well pulverized, which will have the advantage of causing the seed of weeds which may be contained in it to germinate, and of inducing the protoxide of iron contained in every sort of mould sooner to change into the oxide. It is this protoxide which

produces the sharpness or acrimony which is so distinctly perceivable in some sorts of mould. It is also advantageous to scatter it in winter over growing rye, and then harrow it in early in the spring, and roll it. The latter operation is, however, not advisable with a mould which is very light and rich in humus; such mould is better applied when the rye is a few inches long, otherwise it may be carried away by the wind.

If it contains a considerable quantity of vegetable remains undecomposed, it is always advisable to collect it at first into smaller, and then into larger heaps, for the sake of drying it, allowing it to decompose in that way for a year or a year and a half; and this will be still better accomplished if it be mixed with lime, marl, ashes, or dung, or concocted into compost.

LAYING LANDS TO GRASS—THE NEW SYSTEM.

From the Massachusetts Ploughman.

Every farmer of experience has found it difficult to give every field a proper share of dressing from the barn-yard. One lot is ploughed, manured, and planted; a second lot is treated in the same manner; then a third, and so on. But as it has been customary to plant one lot two years in succession in order to rot the sod thoroughly, half a dozen years are required to prepare three lots for grass. Now before the lapse of this term the first lot may need ploughing again, though not one half of the good tillage lands of the farm have had a single visit from the manure cart. The consequence generally is that a large proportion of the tillage land lies unproductive, and the owner says it is not in his power to make farther improvement for want of manure.

Under that old system none of the plough land was turned over except that portion which bid fairest for a good crop of grain, and all those lots which lay low, or between highland and meadow, were suffered to lie unproductive, or to run to bushes and briers.

Now the new system which we have been practising for nine years past professes to relieve the farmer from this difficulty. Instead of planting and sowing so many acres as to exhaust all the manure of the farm, we have been urging the propriety of planting less and of keeping more acres in grass. And in favor of this plan we have been offering to farmers various weighty reasons.

It is known to all men of experience in these matters that hoed crops are very expensive, and that they are resorted to in most parts of New England for the purpose of fitting the land for a more profitable burthen—for grass. Very few calculate on being remunerated from the proceeds of the corn field or the potato field without taking into the account a whole series of crops, including not less than three or four cuts of grass to wind up the series. It is quite common to hear people say they expect no net income from their hoed crops, but that their hay harvests will repay all the outlays necessarily made in tilling.

It is quite clear then that if the hand tilling, or a part of it, can be dispensed with, no loss will ensue to the cultivator. On the other hand if he well considers the subject he will be convinced that "there is much gain, every way."

If he can renovate his old mowing grounds, or a portion of them, without going through with a tedious process of tilling, he not only saves labor but he spares his land, he avoids subjecting it to an exhausting crop, and he can thus give every field a dressing in due season, because each one will require but little manure.

It is quite a common practice to turn a green-sward field in the spring and plant it with corn or potatoes without applying any manure during the first season—a little ashes or plaster being put in the hill to set the corn growing—and tolerable harvests are often obtained under such culture, reliance being placed on the rotting green-sward to carry out the corn, &c., to maturity.

Now instead of letting corn or potatoes have the exclusive benefit of a rotting green-sward, we may rather let the next year's grass have it, for grass is more profitable than grain. Turn green-sward land one month after haying is over and you secure a rowen crop under the sod, more valuable as manure than the grass you turned under in May for corn; consequently but little manure will be needed in addition to this rowen to give the field a good dressing for grass.

It is agreed by all observers that there is no comparison between grass and grain as exhausters of the soil; that it is doubtful whether grass is an exhauster. If grass then is the principal burthen of the field there will be no kind of difficulty in making the field rich; and every one knows that in a great proportion of New England grass is more profitable than grain.

But is it feasible to keep land in grass without adopting a system of rotation embracing corn, grain, and potatoes? This is the point to be proved, and the remainder of this article will be devoted to it, premising that we do not recommend the entire abandonment of any article which the farmer may want for his own use.

Green-sward land may be renovated to better purpose by turning it in August and sowing grass seed on the furrow than by sowing the seed in the spring in company with spring grain. For proof of this we appeal to all who have tried it. We have within four years persuaded hundreds to adopt the practice of sowing grass seed on the green-sward furrow; and we have heard of but just two instances of failure where the rules which we pointed out were observed. These two were in Beverly, where the land was dry and sandy and the seed was thrown on in a very dry time.

It is true we have heard farmers say they had tried fall seeding and did not like it; on inquiry we found they had sowed as late as October—some with manure—some without manure—many had sowed in September, after corn or potatoes had been taken off—or in August, on stubble land turned over but not manured. The consequence was they did not well succeed—the winter killed the roots or the dry weather scorched root and branch.

On the other hand we have heard hundreds complain of the failure of spring seeding within the last two years. When sown with oats, particularly, if the oats did not so spring up as to choke the grass, when the oats were removed the sudden admission of the sun, on plains fairly exposed to the rays, has proved very destructive to the young plant.

It is not contended that all fields can with equal ease be turned so flat as to be fit for sowing without tilling. We speak of the thousands and thousands of acres, lying within forty miles of the capital, which may be so turned and sown. A good plough will turn any tolerably easy land flat enough to be sowed down; and it may be laid more even at this season than in the spring when the land is full of hard lumps.

But in this system we are not confined to the common tillage lands of the farm. We plough all our low grounds that will bear a team. We plough the strips lying between meadow and upland. We plough glades of land that have borne nothing but brakes and rushes, and low blueberry bushes. We plough lands that are not suitable for planting, on account of the springs that gush up in the early part of the year; and we lay these lands as even as a carrot bed. Lands that we could not meddle with in May, we can manage with perfect ease in August.

By turning the sod under and keeping it there, we render the soil more light, and it holds in grass two years longer than it will when it has been thoroughly rotted; and there can be no question but that the green crop of grass, &c., that we turn under will be very suitable manure for the grass that is to follow. Grass must be as good manure for grass as rye straw for a new crop of rye, or as corn stalks for a new growth of corn. But a light top dressing is required in all cases, to insure a good growth for the scythe next season, and to guard against the frost of the coming winter.

As a general rule, the best time for sowing grass seed is about the last week in August. If sown earlier than this, we are in more danger of summer killing—if later, we run more risk from winter frosts. It frequently answers well to sow rich land in the month of September, and we have known very good swaths to be cut in the summer, when the seed was sown the preceding October; but we cannot recommend this late sowing as a safe practice.

If grass is not an exhauster of the soil—and we cannot perceive that it is—how rich any tolerable farm may be made, when the principal product is grass! How light, also the labor of manuring a grass farm, compared with one that has numerous acres in tillage! Lastly, and above all, compare the profits of grass with the profits of corn, or of any kind of grain, in the district extending forty miles each way from the capital, and you will see the propriety of so filling our own markets with hay as to put a veto on all importations of the article from other states. We would rather buy grain than hay.

MAGNESIAN LIME.

Extract from the Farmers' Cabinet.

He says, many farmers in Delaware are very particular with respect to the purity of the lime they use: "One of them informed me, that some of the Schuylkill lime is so impregnated with magnesia, that it is not worth buying; and other kinds so pure, that you cannot buy too much of it." Then follows the stereotyped authority of Tenant and others, "that magnesian lime is exceedingly injurious to land." Now, if this knowledge or opinion of these farmers is the result of a rigorous chemical analysis, conducted by themselves—for it does not appear that any body else examined it—I must congratulate them on their advancement in chemical knowledge; such attainments were certainly very rare among such farmers as I mixed with some years ago; but that was in the *benighted* county of Chester, where it seems that the farmers long cherished an inveterate prejudice against all book-learning. But if they are mere opinions, formed without any knowledge of the true composition of the article they were using, what reliance can be placed on them as a foundation for, or proofs in support of a very important theory? It is against attempts to base a theory on mere opinions, assumed as facts, and from such a theory deducing very important practical consequences, that I have all along been contending; if in doing this I have used strong language, it was not for the purpose of irritating any one, but to arouse attention, and direct inquiry to the subject, and bring theory to the test of facts and practice, closely and vigorously investigated. We have had *namby-pamby* essays enough on the subject, leaning on the authority of great names, and meaning anything or nothing, just as you please. My design was to state explicitly for what I was contending, that my views need not be misunderstood, and if erroneous they might be shown to be so; but in this I may have failed. I have stated it as a fact, that immense benefit has been derived from the use of lime in agriculture, in south-eastern Pennsylvania, and parts adjacent, and that the whole improvement in agriculture, so far as lime is concerned, is due to magnesian lime and to none other. I also stated it is a probable conjecture, though not an ascertained fact, that magnesian lime was better, or at least more economical for some purposes of the farmer, than pure lime.

The first of these propositions your correspondents admit, with a salvo, however, that the improvements might have been greater, if pure instead of magnesian lime had been used. Upon the second point then, the whole controversy turns: Is, or is not the great body of the limestone of south-eastern Pennsylvania of the magnesian variety? All the authorities within my reach, go to prove the affirmative of this proposition. Judge Cooper, many years ago analyzed several specimens from the great valley of Chester and Montgomery counties, collected between Coatesville and the Schuylkill; all or nearly all of which proved, if my memory serves me, highly magnesian. Several years afterwards, the late Dr. Joseph Coates of Downingtown, analyzed several specimens from that neighborhood, which all proved of the same character. The analyses of four specimens from the same district of country, contained in page 309 of vol. 4 of the Cabinet, show them all to contain magnesia; three of them, however, in but small proportions; those, however, it may be remarked, are from quarries which have not been largely used for agricultural purposes; while the other, containing 41 per cent. of magnesia, is from a quarry whence immense quantities have been taken for those purposes. Professor H. D. Rogers, the state geologist, in a letter which I received from him some time ago, states explicitly, that "a very large excess

of magnesian limestone, compared with the pure carbonate of lime, exists in the counties of Lancaster, Chester and Montgomery:" and then adds, "indeed, if I were to confine myself to the great valley of Montgomery and Chester counties, I might say that limestone, free from magnesia, is of rather rare occurrence; the quantity of magnesia, varying in different layers of rock, from 5 or 10 to 40 per cent. The proportion of magnesian limestone, in the secondary blue limestone of the Kittatiny valley, and the Pequea valley, &c., of Lancaster county, is not so great, yet it is difficult to find a quarry in which it does not abound." He further adds that many of the limestones long in use by the farmers of Europe, are as magnesian as our own.

Your correspondent, C. Taylor, thinks I use an expression two strong entirely, when I say, that whatever part of the improvement in south-eastern Pennsylvania is owing to lime, is owing to magnesian lime, and none other; but is it stronger than the above authorities will warrant in the absence of all evidence to the contrary? It was only of its general character I spoke. It cannot be expected that we should analyse every stone or layer of rock that has been used, but only enough to show that magnesia does generally and largely abound.

With respect to the effect produced by any particular lot of lime, we are always willing to take the opinion of intelligent farmers, because such things must always be a matter of judgment; but for the composition of the lime used, we are not to be satisfied with any thing short of a rigid analysis.

If those residing in or near the limestone districts above mentioned, and differing in opinion with me as respects their magnesian nature, wish to bring this controversy to a close, they may readily do so, and at the same time add to our stock of useful knowledge. Let them make a tour through the districts, visiting all the quarries from which lime has been obtained in any considerable quantities for agricultural purposes, and select specimens from each, particularly of those strata which produce a lime held in the best estimation, and let the specimens thus obtained be submitted to a careful analysis by some competent chemists. The results of such an investigation, when made public, ought to, and will, in the minds of all reasonable people, settle the principal point in dispute. S. Lewis.

Pottsville, July 20th, 1842.

SEEDING ON GREEN-SWARD FURROWS.

Form the New England Farmer.

Mr. Butman.—In your paper of the 31st of August, there is an inquiry, in what part of the state the experiment has been made of seeding on green-sward furrows, and how the farmers liked the practice. We are disposed to give "Essex" information concerning our experience and practice, without participating at all in the dispute whether this be old or new husbandry.

Some twenty or twenty-five years since, the writer was told that Mr. Z. Estis, of Hanover, practised ploughing sward-bound fields, manuring and seeding with grass, without any intervening crop. The first suggestion of such a course was sufficient inducement to make an experiment, as much fruitless labor and expense had been given in attempts to raise grain crops on cold and clayey soils. Every experiment made has been attended with very satisfactory results. There is no loss of crop in the course, and yet most of the purposes of naked fallow are fully accomplished. The gradual dissolving of the sod prevents the soil from falling into too compact a state, (a common evil on low lands,) and imparts nourishment for many years to the new grass. We have a field which was ploughed and seeded in August, 1825: it has not been very frequently or copiously dressed with manure, and is still in better condition than mowing fields generally. Another field, seeded twelve years ago, and dressed once in two years, produced this year a very large first crop and a second is now ready for mowing. This practice is worthy of all commendation on land not suited to grain crops. Where Indian corn would be likely to grow well, we should think it a more economical and better course to plough in the spring, apply manure, plant with corn, cultivate with a level surface, and sow grass seed at the last hoeing.

"Essex" seems disposed to blame farmers for neglect in communicating to the public, if the system concerning which he inquires has been pursued "for a long course of years." Remissness in communication is no doubt an easily besetting sin, and the writer will not deny that it sometimes lies at his door; but on this subject there is no consciousness of any improper reserve on his part;—all suitable occasions have been embraced to direct the attention of farmers to a practice so intimately connected with their interest and prosperity. All practicable publicity has been given to views entertained on the subject. In an account of the cultivation of the writer's farm, which was published in the N. E. Farmer, vol. x., page 360, this practice was mentioned as part of the system pursued. In the county of Plymouth, the practice has not been extended proportionate to its utility; but we have the satisfaction of seeing a good number of farmers every year adopting it, and where one experiment has been fairly made on a farm, an intelligent owner will be very certain to repeat it. M. Allen.

Pembroke, Sept. 2d., 1842.

This communication induced us to turn to the back volume where Mr Allen detailed his modes of farming, and we found a part of his account so full of instruction that may be valuable to many of our readers, that we make no apology for re-publishing it.—Ed. N. E. F.

To the trustees of the Mass. Agricultural Society:—Situated at a distance from any considerable market town, it would be absurd in me to think of entering into competition in the aggregate amount of crops, with farmers in the vicinity of the city, where manure is attainable to any desired extent. On the supposition, that the management of farms is judged in reference to local advantages and inconveniences, my hope is founded of sustaining a claim to a premium. There have never been any very great improvements made on my farm in any one year. The object has been yearly to add something more in earthy and vegetable substances to the fields, than was

taken from them in the removal of crops. To give a just idea of improvements made, a brief history of the operations may be necessary.

My first purchase of land was in 1802—fifteen acres; the greater part of which was in a very rough state, and, as much of it had been tilled, reduced by severe cropping. The rocks were removed to enclose the lots, and the bushes subdued with the plough, as fast as necessary means could be obtained for accomplishing those objects; the progress was not rapid in the beginning, because, being entirely destitute of capital, I was obliged, in seaman's phrase, to 'work my passage.'

"When the fields were enclosed with walls and the bushes subdued, attention was directed to the plats which had been tilled almost to exhaustion. And the principal means of renewing them within my power was the incorporation of earths of different qualities. Cold and tenacious soils were dressed with silicious earth and other materials that tended to open and warm them. Sandy soils were dressed with clay, swamp mud, and alluvions in which sand formed the least considerable part. This course, in seven years, gave ten tons of English hay where less than two were obtained before, and about double the quantity of grain on the acre.

"In 1817, another lot of sixteen acres, a large portion of it in a similar state with the first, was purchased and managed in the same way. About the same time were purchased seven acres of fresh meadow; on which no other improvements have been made than clearing away bushes, tunnelling and cutting ditches in such directions as would irrigate the whole meadow. Another small lot was enclosed from a pasture in 1820, and has since been cultivated as English meadow and tillage. Four acres of the above lots are light sandy soils; six acres hazel loam, suitable for grain or grass; five acres dark friable soil; fifteen acres argillaceous; and ten acres of irrigated fresh meadow. Seven acres were planted with Indian corn the present year—three acres of loam and four acres of sandy soil. On one acre of the loam about six cords of barn manure were spread and ploughed in; on another acre, where in other years meadow mud had been applied, six casks of lime were spread; on the other fields, which produced rye the preceding year, there was no application. The corn was planted in drills: this method has been in practice on the farm more than twenty years, and is in my judgment preferable to any other. The corn was harvested between 20th September and 20th October. Weight of the whole crop, 22,381 pounds—298 31-75 bushels. The same field the preceding year, produced 120 bushels of rye. The present year there were only about two acres in rye, and the produce was 25 bushels.

"There are nine acres in tillage, alternately planted with corn and rye, excepting once in five or six years each field is planted with potatoes, beans, or some other vegetable considered favorable as a change from the ordinary course. The stubble of rye is ploughed in, immediately after the removal of the crop, and some kind of seed applied to produce herbage to be ploughed in as green dressing. Potatoes this year were planted only on the borders of corn-fields, under trees, and in other situations where not much produce could be expected—eighty bushels were gathered. From two hundred to three hundred has been the average crop in the last four years. No other roots are cultivated except in the kitchen garden. Thirty-two acres are mowed, twenty of which have been ploughed and will produce good English hay in common seasons, with liberal manuring; but a succession of wet seasons has introduced on a part of it so much wild grass, that the hay is not now suitable for the market, though good stock hay. There are ten acres of irrigated land, as above mentioned, and two acres of fresh meadow over which the water does not often pass. The hay was located before the offered premium was published, in such manner that it is impossible for me to ascertain with accuracy the quantity. Some of it was placed in barns with old hay, and some of it sold in the fields. The crop of hay has varied very little for four years, yet supposed to have gradually increased. In 1827, the whole crop was measured in the mow in September, after it was thoroughly settled. Four cords of English hay were considered equal to a ton, and five cords of fresh. According to that measurement, there were thirty-three and three quarter tons of first quality, or good English hay; ten tons of second quality; and fourteen and two-fifths tons fresh hay. Five acres then mowed are now in tillage. From two to three tons of second crop are annually cut, in situations where it is not convenient for cattle to feed.

"Compost manure, made with reference to the quality of the soil where it is to be applied, is every year spread on the mowing land. Sand is made a principal ingredient of compost for clayey soils, and swamp mud or clayey for loose soils. From three to five hundred loads, forty bushels in the load, are made in a year and applied chiefly in autumn, not so much for choice as necessity, there being no other season of sufficient leisure to accomplish the work. In laying down tilled land to grass, I choose to sow the seed about the last week in August and put no grain with it; but any time in the month of September will do better than either of the spring months; and if sown with winter rye, it will do better than with spring grain. The clayey soils which are not suitable for grain, I sometimes turn over with the plough immediately after the grass is cut, roll down the furrows, and put on a dressing of manure and seed again. In this course cultivated grass is renewed without the loss of any crop. I used chiefly herds-grass seed, and put one-fourth of a bushel on an acre.

"I have forty acres of pastures of a light soil, and in the possession of other owners, it was alternately tilled and pastured in so quick succession, that only very small crops of corn or rye can now be obtained. The number of acres discouraged me from attempting to renew it in my usual way of mixing soils; and therefore a plan is formed to renew it in the operations of nature. Last spring, a field of between two and three acres was fenced, ploughed, and sowed with the seed of the yellow locust tree. The seed came up well, and the most thrifty of the young trees are now three and a half feet high. If the worms should not oppose me, there will probably be a very flourishing grove, which in a few years will effectually recruit the soil. In this connection, it may not be amiss to mention, that I have this fall sowed five acres of common land with the seed of white pine, and am now planting several acres with acorns, which it is intended to protect against cattle with a fence."

FALSE PRETENCE OF THE BANKS OF HAVING RESUMED PAYMENT.

The 15th of this month was the day when, according to the previous promise and annunciation of the ridiculous convention of bank presidents, the banks of this state were simultaneously and fully to resume payment, 45 days in advance of the time when the law will compel that measure. And accordingly, on that day, as the banks and their newspapers declare, they *did* resume payment. Moreover, it is a matter of boast in the newspapers, (according to usage and established precedent,) that very few demands for specie have been made on them, (and almost none of any consideration,) which fact is assumed as evidence of the still abiding confidence of the community in these self-degraded institutions. We dissent entirely from these inferences and assumptions; and, further, declare that there has been no real or *bona fide* resumption of payments; and that the present action of the several banks of Virginia, which is claimed to be resumption of payment, is but a new or rather continued part and parcel of the general system of falsehood and moral fraud which characterize the whole legalized banking system and policy, and consequent banking operations, of the state of Virginia.

The legal *branch feature* of the banks, alone, without any designed action on the part of the banks to use it for fraudulent ends, would of itself protect them from paying specie better than any specific obstruction imposed by law would serve for independent banks, having no branches. But this protection becomes incalculably greater, when the facility offered is used, as it has been by the several banks of Virginia, to send the notes of each branch as far as possible from the place where alone they are payable. The dishonest course has been regularly and for a long time pursued, of issuing at each bank and branch as few as possible (indeed almost none) of its own notes, but issuing, instead, the notes of other branches, as remote as possible. Thus the branch bank of Virginia at Petersburg, regularly issued notes for $1 and $2 (which the law required to be paid in specie, but which requisition was thus easily and effectually evaded, as the law makers, i. e. the bank presidents, designed it should be,) of the Buchanan branch; and we presume that the Buchanan branch issued those of the Petersburg or Norfolk branches. Wytheville is the place of payment for most of the Farmers' Bank small notes issued and circulated here. The same general course has been pursued by all, and the banks had this means perfectly in their power as to their general issues, because during the long past time of their suspension of payment, there was no reason or inducement for any individual to prefer a Petersburg or a Richmond note to one of Wytheville or Charlestown, when neither was payable in specie; and neither was there any mode left by the law and the courts, to compel a bank to pay in even its own notes, instead of those of a distant branch.

The effect of this long continued procedure is, that the circulation of each town in Virginia, and its surrounding country, is filled entirely with bank notes of distant banks and branches, (or of foreign bank notes, serving the banks' purposes even better,) and scarcely any notes are to be met with of the banks or branches close at hand. We infer this from the state of things in the town in which we reside. It is here very rare to see a bank note payable at either of the three branch banks located here.

What renders this procedure of the banks still more conducive to its dishonest end, is that in or for Virginia there is no one centre of trade. If the ultimate market of all the state was either Richmond, Norfolk, or even New York directly, the bank notes, no matter how scattered at first, would soon reach places where they are payable. But unfortunately for the general interests of this state, its trade is divided between its Atlantic towns, and Baltimore and the Ohio and Mississippi markets. And there is less trading intercourse between each two of the three great producing regions, than there is between Richmond and Liverpool. This condition and separation of trade and of markets multiplies the facilities of the banks for keeping their notes away from the only places at which their payment can be effectually claimed.

Having thus well prepared to meet all possible contingencies, the banks have delcared what they call a resumption of payments. And how have they resumed? They still refuse to pay specie, or even their own notes; for checks, whether drawn upon general deposites or for debts collected. And all that they will pay is their own notes, when any such by chance stray homeward from the distant places in which only they were issued for circulation. And, thus, even if every holder of a note, or other obligation really payable in specie at home, were to *dare* to demand specie for it, there would be no possibility of any early and considerable demand being made on any of the banks. But, nevertheless, their day of reckoning is not far distant. There is now existing and

operating an object to induce their distant notes to be sent homeward, and in a few months they will be at hand and in very inconvenient quantity. And after November 1st, the banks can no longer avail of the present false pretences of paying, and yet effectually withhold payment.

Eighteen months ago, we endeavored to expose the like exercise by the banks of the same false pretences; and we shall copy the statement then made, as being as applicable now as then, (March 1841,) when the banks pretended, for a very short time, and falsely pretended, in like manner, to pay specie, before they again boldly refused it altogether.

"It is one of the common arguments of the day, which we may hear any where in the streets, and which are as current as the banks' "*promise to pay*," that "the bank has received on deposite all sorts of notes —not only of all the branches in Virginia, but of the banks of North Carolina—and that it would be monstrous, and most unreasonable and unjust, to demand specie for checks drawn for deposites so constituted." Now, in the first place, the rule thus set up for the bank, if good, should work both ways. If North Carolina notes, for example, are to be paid out to checks, because such notes had been deposited, (*by the bank's own rule*, adopted for the bank's own benefit,) either by the drawer, or by others, in ordinary business, then it certainly would follow, that a depositor of specie, or of notes issued by the bank, should rightfully draw specie, or these only specie-bringing notes for his checks. Yet it is well known that such would *not* be permitted, unless as a matter of favor to the drawer, and a departure from the rule of the bank's *right*. All checks, for money previously and generally deposited, stand (and of right ought to stand) on equal footing; all deposites which the bank chooses to receive as its own notes, are thereby made the same (as to that bank) as its own notes; and the bank is in every sense bound to pay for them in its own legal and proper currency. If the consequences were likely to be inconvenient or injurious, and *if the practice had not been adopted for the special benefit of the receiving bank*, it would be very easy for it to refuse to receive deposites in any notes except such as it agreed to redeem in specie; or, if receiving them, to return them for payment to the banks whence they issued. But this returning of foreign notes, and receiving their own, is precisely what the banks wish especially to avoid.

But, in fact, (though it is not required to sustain our position,) it is just as convenient and easy for a bank to pay specie for deposites made in one kind of *paper* as another. Whether a deposite be made in the notes of the bank receiving the deposite, or of North Carolina notes, it would not add a dollar to the bank's stock of specie; nor would the payment diminish that stock more in the one case than the other. If then it be true, (as is alleged in defence of the banks,) that it would be "impossible for them to pay specie for deposites made in foreign notes," it is equally true that it would be just as impossible to pay them if every deposited note had been of their own issue. We are very willing to admit the impossibility in both the cases.

As it presents a curious incident in the history of the progress of irresponsible banking in this country, we will copy the notices of this bank, (signed by the cashier,) under which it claims exemption from paying checks, and seeks to avoid all such demands. They are now stuck up at the counter of the Branch Bank of Virginia; and under these, or some equally potent safeguards, the like exemption from paying checks is maintained by all other banks in Virginia.

"*Notice.*

"All deposites made in this office are to be considered as made in current bank notes.

"Oct. 16, 1839."

"*In addition* to the above notice, depositors are further notified, that in order to avoid any difficulty at the counter, they are required to make their checks payable in CURRENT BANK NOTES.

"Feb. 11, 1841."

Thus, if this be indeed a "specie-paying bank," (and if this is not, then there is certainly not one in Virginia,) it is guarded at all points against paying specie to any extent either injurious to the bank or beneficial to its creditors, or to the public interest.

First, all of its own notes (by some means, whether designed or accidental, natural or supernatural, it is not our business to establish) have been taken out of the home circulation, and substituted by others issued by remote banks; and, therefore, readily as its own notes may be redeemed by the bank, there are almost none that can be presented for redemption.

Secondly, all deposites are rendered irredeemable in specie, by virtue of the above notices; or in any other currency than the worst paper money which the bank may choose at any future time to receive.

Thirdly, even if the bank authorities opposed no such obstacles as are above stated to the making payments in specie, the fear of their enmity, and the tremendous influence which they wield over the trading community, would deter nearly every individual from claiming his just rights.

And fourthly, lest all these safeguards should prove too weak, the aid of new legislative enactments will be called in, and of which the purport and force are yet to be seen; but which will certainly fail of their designed object, if they do not secure the banks still more effectually than now, against all possible demands to pay their debts and comply with their obligations.

The three banks in Richmond, like the one spoken of here, pay bills of their own issue only; and still more strictly pay no checks, and have paid none, (as a general rule,) since their pretended resumption. It is only a matter of inference that all the other banks and branches in Virginia do no better, and therefore are *not* now, nor have they ever been, even for a day, truly specie-paying banks. And if any doubt now exists, we think it will be speedily removed by their admission of the fact of general re-suspension. That will probably be the acknowledged state of things before this article can be issued from the

press. The North Carolina banks, which occupied precisely the like grounds, (of pretended resumption of payments, and real continued suspension,) have already, since the foregoing remarks were written, thrown aside the thin disguise, for the purpose of saving the brokers the trouble of collecting their notes to obtain specie, and themselves from the odium of refusing to pay while professing to be "specie-paying" banks. The Virginia banks will all follow the same course as soon as it shall be deemed less profitable to them to keep up the present deception, than to publish the truth of a general refusal to pay all demands. If the lapse of another week does not bring them to this result, two months certainly will."—*Farmers' Register for March*, 1841.

The predictions made in the latter part of the foregoing extract, were all fully and speedily verified.

While the banks are thus guarded at all points (except from the demands of foreign and other brokers, who can arrest their notes in their distant circulation,) from paying any considerable amount of specie, it is as ridiculous as it is deceptious for their mouth-pieces to talk about the small amount of demands made on them for payment. Let the banks lay aside these defences, (which would stigmatize and disgrace any individual, as a shameless and fraudulent bankrupt,) and resume payment *bona fide*, and then they may with something like truth claim whatever may appear of the forbearance of the community to demand payment. As it is, it would be nearer the truth to say that they are *required to pay every existing* and *valid obligation*; for of the very few notes of $5 or more in home circulation, scarcely one passes through the hands of three individuals, before it goes to the bank to be redeemed. If the few $1 and $2 notes remain somewhat longer in home circulation, it is because they singly present too small an object to the holder to seek payment. If all the notes of the banks and their branches were in home circulation, they would be presented for payment so rapidly, that the next avowed suspension of payment would probably recommence almost as quickly as happened in Virginia in February 1841, and lately in regard to the banks of New Orleans. Whenever the banks of Virginia shall *avow* suspension again, they will continue suspended to the rapidly approaching end of their long continued fraudulent course and present legal existence. And after November 1st, nothing will prevent the early commencement of that state of things, except new legislation to protect bank frauds, or, otherwise, that actual degree of confidence of the people in the banks, which is now claimed for these institutions, as operating, but which they take especial care to guard against being tested.

REMARKABLE EXTENT OF THE SECOND BLOSSOMING OF TREES.

To the Editor of the Farmers' Register.

Sandy Point, Sept. 20th, 1842.

Amongst the many ravages committed by the severe storm of wind and rain which passed over this section of country on the 24th of August last, was the nearly entire stripping of the leaves from that side of the fruit and other trees exposed to its unusual violence. On those trees, so prematurely and roughly denuded of their covering of leaves, nature is now making a vigorous effort to restore those appendages, even at this late season, which I think is well worthy of record. The unusual, beautiful, and interesting anomaly is now presenting itself, of apple and other fruit trees in full and perfect blossom. Instances of this nature, I am aware, occur (to a very limited extent) almost every season, particularly on plum trees, but never have I seen so general a flowering. Some apple trees here are as amply and completely covered with blossoms as generally happens to them in their natural flowering season. Where apples have not been entirely shaken off the trees by the violence of the storm, a dish of fruit can be gathered from one side of the tree, and a bouquet of flowers from the other. Pomona and Flora are here as intimately hand in hand as they are on many of the plants of the citron family. The apple is not the only tree which presents this interestingly beautiful phenomenon; the plum, cherry, pear and walnut exhibit the same; and on one side of a double flowering cherry, (exposed to the storm,) there is a good display of the beautiful blossom natural to that tree.* A few blossoms of apricots are also appearing. A plant of Persian lilac is in full bloom, and the buds of many other flowering shrubs show an evident tendency to speedy developement, if not shortly arrested by early frosts. I have thought the interesting character of these unusual but natural effects, the efforts of nature to replace a beautiful portion of her works, so unseasonably destroyed, well worthy of notice. Some sages, from these appearances, prognosticate that the now approaching winter will be a severe one; others, that some fearful and direful calamity is about to pass over the country.

A. Nicol.

SOWED CORN.

From the New England Farmer.

It may amuse, and perhaps be of some advantage to the agriculturists of the country, to be correctly informed to what extent of production the soil may be relied upon or referred to. This is especially important to those who have but little

* Many of the petals of these show a tinge of red not natural to them, fit emblem of the hectic on many a young and fair cheek destined like them to premature decay.

land to cultivate. My attention having been drawn, in past time, to this subject, I this year (1842) appropriated a piece of ground for the purpose of sowing in broadcast (so called) a quantity of Indian corn. Relying on the prevalent saccharine matter, thought to be therein contained, I took what is commonly called sweet corn. It came up well, though its growth was not comparable with that planted in the hill. At the first appearance of the spindle [tassel] a portion of the lot of average appearance was cut, and two careful persons were my assistants in weighing the product (August 22.)

The production was as follows: 272 1-2 square feet or one rod, gave at the rate of 13 tons 1225 pounds to the acre. It may be well here to observe, that after spindling, at several subsequent periods, there was a decrease of weight.

My next experiment was made with Southern flat corn. This was scattered in rows. The growth was rapid, favored by the season. This too was taken as the spindle began to appear, and the production was calculated in like manner as in the preceding case, and was a little over 21 tons to the acre (Sept. 2d.)

In both cases these crops were fed out in aid of the pasture.

The result in both these experiments would seem to give great force to the system of soiling, well thought of and recommended by so many agriculturists. JOHN WELLES.

Natick, Sept. 6, 1842.

NEW JERSEY MARL BEDS.

From the Farmers' Cabinet.

We have rarely passed a day more pleasantly, in any little excursion, than we did the 2d and 3d insts., in company with our highly valued friend, Edmund Ruffin, editor of the "Farmers' Register." He was desirous of viewing some of the *marl beds* of New Jersey, and we made a flying visit to a few of them in Gloucester county, about five miles south-east of Woodbury. There has already been a good deal said and written upon these remarkable deposites; as well as upon the almost incredible effects that have resulted from their application to the soil; but much more information is requisite, before their value will be thoroughy appreciated, or their character distinctly understood, especially by those who have not seen them. It is not our intention to make even the attempt to throw any new light upon this exceedingly interesting subject; but merely to name the places we visited—a few of the results mentioned as having grown out of the use of marl, and to draw if possible the further notice of others, to these abundant sources of wealth, to our native state.

It is well known the marl region of New Jersey stretches through the interior of the state, from Monmouth, across the entire breadth of Burlington and Gloucester counties, and penetrates, also, the upper parts of Salem. The beds lie at various distances from the surface, and of course offer every difference of facility in excavating them, and are overlaid by a great variety of material. Our friends, Benjamin Whitall and William R. Tatum, accompanied us in our ride, and from their familiarity with every location in their neighborhood, were enabled to make many interesting statements, with respect to the change which the use of marl has made in the face of the country. We visited the marl bed of James Davis, which lies a mile and a half east of Woodbury, and two or three miles to the west of the western limits of the district which includes the green-sand marl. It lies in the bottom of a valley, covering a few acres, and is overlaid with bog iron ore, of so much richness, as to have been purchased some fifteen or twenty years ago, by a person of the name of Richards, and transported, principally by water, to his iron works on Egg-harbour river. This marl appears to be intermixed with sand and clay, as well as some ferruginous matter, and is apparently destitute of any calcareous substance. The owner has used it recently to great advantage; and William R. Tatum showed on some of his own higher ground, a lightish sandy loam, evidences of great beneficial results from its application to grass. We next called upon our friend, John L. Cooper, of Good Intent, near Blackwoodtown, who showed two beds at different elevations, in the hill on the north-west margin of his mill-pond. This is a hard, reddish colored substance, with a good many decomposed shells, and smelling considerably of sulphur. It was used to some extent and to some advantage, thirty years ago, but is now neglected. A mile further on, a little beyond Blackwoodtown, and on the same stream,—the head of Timber creek,—is David E. Marshall's genuine green-sand marl; apparently the *pure* substance. This lies in the hill, on either side of the stream, is ten or fifteen feet in thickness, and is overlaid by four, five, or six, or eight feet of sand and gravel, and also by a hard material of a few inches thickness, resembling iron stone. This marl is much used, and to great purpose. It is hauled ten or twelve miles, and with the other marls of the neighborhood, is generally spread as a top dressing upon grass, in the spring, at the rate of ten to fifteen tons per acre. On inquiring at the pit, of a person who was digging and hauling it away, whether the owner, D. E. Marshall, had himself used the material to much extent, and to great advantage; he replied in the affirmative, with a look of astonishment that such questions should be asked, and an earnestness of manner, that was a strong pledge of his sincerity. In looking for proofs of its usefulness on D. E. Marshall's farm, he said we could hardly go amiss. We, however, did not walk over the farm—we had not time to do so; but the fact, that its fertility had been vastly increased, by the application of this marl, was familiar to three of us. We next passed on to the extensive excavations of Josiah Heritage, on the head waters of Mantua creek, and two or three miles south-west of D. E. Marshall's. This also is green sand, or as it is also often called, gun-powder marl, of the first quality. It is carted ten or a dozen miles, and applied with an effect that is really astonishing. Among the green-sand, which is from ten to twenty feet in thickness, no organic remains are to be discovered. It lies on either side of the creek. The present operations are on the north side. It is covered with sand and gravel to the depth of six or eight, or ten feet, as well as by a marl of a reddish brown appearance, that is of considerable value, though far inferior to the green-sand marl. In some

places, a solid layer of what were once shells, fifteen or twenty inches in thickness, separates the sand and clay, &c., from the upper, and less valuable stratum of marl* just mentioned. And the green-sand itself, lying along a little ravine that juts up from the main stream, is overlaid by a dark brown limestone, ten or twelve inches in thickness. This stone is intermixed a good deal with shells, and a kiln has been built on the adjacent hill side, for burning it. We had not the satisfaction of seeing J. Heritage himself, and could not of course, ascertain exactly the quantity annually taken from these pits. Our friends however, who are familiar with the operations there, drawing away, themselves, more or less every season, believed that six or seven thousand tons must have been removed last winter. It is sold by the rod, or by the ton, say 10 to 15 dollars the square rod, and the purchaser digging it himself, or 37½ cents a ton, the owner uncovering it, and making it of easy access to the team.

The green-sand marl of this neighborhood, and it is of that only we speak, is best adapted to what are often called *natural* meadows—to lowish moist, but drained lands—to cold, sour quicksandy soils, where the springs are near the surface, and the virgin soil was naturally poor. These are the soils that the gunpowder marl of this vicinity best suits. We do not say it does not benefit some other soils; but from all we learned and from our own experience, it does little or no good, when spread on grass, on a light, sandy soil; and especially if the sandy soil reposes upon a sandy subsoil. All the different marls of the neighborhood, however, appear to be decidedly beneficial to a potato crop, and that too, on every variety of soil at all suitable for potatoes.

On the road from D. E. Marshall's to J. Heritage's, we passed through the farm of Thomas Chew. It contains 160 or 175 acres of cleared land. Eight years since, it was poor, and exceedingly unproductive, scarcely affording pasture and hay for eight or ten cattle and horses. Some six years since, the owner, observing what was passing around him, and concluding that Heritage's marl was adapted to his land, entered with considerable and praiseworthy spirit into the work, and has marled nearly all his farm. We were assured that, during the summer just passed, more than 100 tons of hay were cut on this same plantation, and that the summer stock is at least quadrupled.

On Joseph Whitall's farm, one mile south-east of Woodbury, is a bed of dark bluish clay, intermixed with shells, which he has used to considerable advantage on his higher and lighter grounds, where the green-sand marl is of little or no use. A much heavier dressing, however, is necessary with this material, than with the green-sand, on the lower grounds. This farm, with those of W. R. Tatum, Joseph D. Pedrick, James Davis, D. E. Marshall, Thomas Chew and J. Heritage, were named to us, as having been vastly improved by the application of marl. On many others in the neighborhood, similar improvement is perhaps not less obvious. The above are named, because we passed through, and saw them ourselves, in our little ride. One more fact, and we are done. All the beds of good green-sand marl, that we have any knowledge of, in the counties of Burlington, Gloucester and Salem, lie on the head of our creeks, above the reach of the tide, and west of the ridge which separates the streams of the Atlantic from those which flow into the Delaware.

It was said above, that nothing new was to be looked for, in these cursory remarks. They have been confined to what came under our own eye. Speculation has been avoided. We do not undertake to say, of what these extraordinary deposites are composed; how, or whence they have been gathered, or in what their fertilizing quality consists; and for this very plain reason, we do not know any better than our readers. We anticipate, and we partly promise to the public, an article from our friend of the Farmers' Register, worthy of himself, and creditable to this broad subject. We shall impatiently await its appearance.

* All earths are called *marl*, in this neighborhood, that are found useful for agricultural purposes, when applied to the soil.

THE SANDY SOILS OF DELAWARE, AND THEIR FORMATION.

From Booth's Geological Survey of Delaware.

To the traveller who for the first time passes through Sussex county, the formations would undoubtedly appear to consist almost wholly of loose white and yellow sands, but a more thorough investigation shows the fallacy of such a conclusion, proves that in reference to geological deposites, the argillaceous greatly predominates over the sandy, forming the substratum of the whole county, but that the latter overlying and capping the clays over a large proportion of the surface, communicates the well-known sandy character to the soil. These upper sands probably cover one-half or two-thirds of the county, are of very variable thickness, sometimes yellowish and more tenacious, at others nearly white, and so loose, as to be readily transported by the winds. We have had occasion to notice them casually, while describing the lower clays, from Milford through the eastern and south-western portions of the county. Along the eastern border they are generally of inconsiderable thickness, from six inches to several feet, and the lower clays may often be thrown up by the plough. Towards the S. E., the sand is unusually white, and may probably be found of sufficient purity for the manufacture of glass. If this formation be examined in the vicinity of the coast, its very undulating surface must strike the observer. A surface we would suppose to be more level from its position, we there find to consist of a series of hillocks apparently following no law relative to form, size, or situation, consisting wholly of light sand sometimes bare, but generally covered with herbage. The sand is so slightly coherent, that often where the sod has been removed in an exposed situation, the action of the wind roots it out to the depth of several feet, distributing it over the surrounding soil or heaping it against a bush, fence or other obstruction. The formation of *dunes* along the coast at Cape Henlopen is due to the same cause. As the fine sand thrown up by the waves of the ocean becomes dried, it is raised by the wind, and deposited on the sides of the present dunes, which were first

formed by its lodging on the outer edge of a pine-forest. They stretch along the shore for some distance, enclosing one of the light-houses, and imburying many of the trees, some of which were about 40 feet in height, and yet their tops only appear on the dunes like small bushes. These dunes are evidently of very recent origin, and still in the act of forming, as is proved by the moderate age of the trees, and the want of herbage on their surface. The whole forest against which they have lodged appears, from the very undulating surface of the ground, to have sprung out of the remains of more ancient dunes. Similar appearances are observable near the coast in Baltimore hundred, and may be traced for several miles inland, until the undulating surface gradually becomes more even, and forms the ordinary superficial stratum of light sand.

That the superficial stratum of sand is due to the destruction of sand dunes is more clearly seen in the western portion of the county, where the arenaceous stratum is much heavier, often attaining the thickness of 20-30 feet, and many of the ridges of loose sand are nothing more than dunes which have resisted the destroying influence of the wind, and may be traced from the lower hundreds to the sources of the Nanticoke in the southern part of Kent county. Indeed, in whatever direction we approach the Nanticoke, from its source to the point of its crossing the state line, a range of sand hills strike the observer from their frequency—often from their continuity, their steepness, and the lightness of the sand composing them, circumstances which would at once induce him to refer them to the same origin as dunes. The sand is of so loose a nature, that where the sod is removed, it is very liable to removal by the wind, to the great annoyance of agriculturists. While alluding to the forest lands of the upper counties, we have incidentally noticed the existence of sand hills, which increasing in number and extent as we approach Sussex, and gradually passing into the sand dunes, must be attributed to the same origin. But although we meet with the sand in great abundance in the form of detached and connected hills, the greater portion of it constitutes a nearly level covering to the subjacent clays, varying in thickness from 1 to 20 feet, and covering a large amount of surface in the south-western part of the county. In N. W. Fork hundred, the greater part of it is in the form of hills, and there is a comparatively small amount on the dividing ridge, where the soil is usually more or less argillaceous. This formation of light sand should not be confounded with several ranges of gravel hills in the county, which have a totally distinct character, although they are partially covered with the sand. The most striking of these ranges is one lying to the south of Milton, and between Georgetown and Lewes. It is a ridge of variable breadth, not more than 50 feet in height, extending for several miles apparently in a N. W. and S. E. direction, composed of fine gravel and sand with a sufficient admixture of clay to render it compact. Its isolated situation in a region composed of such different materials has attracted the notice of the inhabitants, and given rise to a variety of conjectures relative to its origin. It is undoubtedly to be referred to the same causes, formerly in action when the land was beneath the water, which are now operating in the bay to form shoals and bars, and which, if the whole bottom of the bay were elevated, would present the similar elevations composed of sand and gravel.

Reviewing what has been said relative to the sand in the two preceding sections, we find that it is a stratum covering one half or two thirds of the county of Sussex, and extending partly into Kent, composed of a light-colored sand of a fine and even grain, containing scarcely a trace of argillaceous matter, excepting on its surface, and so loosely deposited as to be liable to shifting from the action of the wind, that the greater part is distributed as a loose covering over the surface, from 1 to 30 feet, but probably averaging 5 feet in thickness;—that it is frequently drifted into the form of hills, closely resemblimg the sand dunes still forming on the coast near Cape Henlopen, and may be refered to the same origin.

IMPROVEMENT OF SANDY SOILS.

From the American Agriculturist.

In a short jaunt we have recently taken through that paradise of New England, the Connecticut valley, we have witnessed a success in the reclaiming of worn out sandy lands, which we hardly dared to expect with the ease, economy and facility with which it has been accomplished. The Hon. W. Clark of Northampton, has been the great pioneeer in this course, and from the successful results he has achieved we may fairly class him among the great agricultural reformers of the present day. He has already given to the public the theory of his operations, which we hope to find room to lay before our readers at some future time. Our object now is simply to give his *practice*, and after our farmers have begun the good work of reclaiming their almost barren wastes, it will be a pleasure for them to look into the modus operandi, and see the reason of their success. There are three essential features in this practice, and the simultaneous adoption of each is essential to effect the desired object. The first is the frequent and thorough use of the *roller;* the second a constant covering of crops on the ground; the third is the introduction of clover and grass as a fertilizer. To illustrate this, we give the history of a single field of some 40 acres of worn out sandy soil, in the vicinity of N. This field was purchased by Mr. C. some eight or ten years since for nine dollars per acre, while the fertile bottom lands on the other side of the town, would sell readily for $150 to $200. His object was first to get a crop of corn if possible, and the land being too poor for this, he carried on to it a moderate quantity of peat or swamp muck, which was found in the low places on the same field. We may observe, in passing, this peat and muck exists to an almost unlimited extent throughout New England, and we consider it of vastly more intrinsic value to the community that all the gold mines that have dazzled the eyes of our southern neighbors for the last fifteen years. With this dressing, say of fifteen to thirty loads to the acre, the whole cost of which consists in simply digging and throwing into heaps to be drained, and acted on by the atmosphere, after which it is carried either by carts or sleds in winter on to the adjacent ground; the

land is then ploughed, and whatever scurf, sand, grass, rushes, mosses, pusseys and briers there may be on the land are turned under, and such is the *digestibility** of the soil all these raw material are at once converted into humus or geine as food for the required plants. This sandy soil has the stomach of an ostrich, and if it cannot, as that voracious biped has the credit of doing, digest old shoes, iron spikes, and junk bottles, it can dissolve and convert into vegetable chyle, whatever organized matter is given to it. The effect of this comparatively slight dressing yielded a first crop of some thirty bushels of corn to the acre, enough to pay for the first cost of the land and the whole expense of producing it. But while the corn was growing, say from the 20th July to the 10th August, rye with red and white clover seed was sown, and the corn being so planted as to admit of harrowing two ways, or even four if necessary, it was well got in with the harrow, and the ground being amply protected by the corn during the sultry weather of this season, the new seed took a vigorous start, and as soon as the corn was somewhat matured, it was cut and carried off the ground, and the new growth then had the entire possession. The roller was then thoroughly applied, as also in the following spring. The early sowing gives strength to the roots of both rye and clover, and renders hazard of winter killing either, especially the clover, much less. When from any cause he is prevented from sowing the clover early, it is omitted till early in the following spring; a postponement that should be avoided when possible, as it thus loses a year's time, requiring another season to mature. The rye is cut the following summer, when the clover is suffered to remain, shedding its seed upon the ground for a successive crop. The following season, if in proper condition, it is again put into corn or rye according to its fertility, and the course is again renewed. The land however usually requires an additional season in clover, and sometimes more, to give the requisite fertility. Mr. C. showed us a field, which from the originally poor condition described, without the addition of any manure or peat or muck, has produced him five crops in seven years, the last, which had been just taken off, yielding seventeen bushels to the acre. This it will be readily admitted is a large crop for poor land, and much beyond the average yield in New England. The growth of the clover on this field, of this spring's sowing, was promising in the highest degree, and as evenly set as in the best land, giving every promise of a large crop the next season, which of course is designed to be added to the soil for its future improvement. When the land is first put into use, (for Mr. C. has several other similar fields which have been variously treated, though always on the same principles,) and it is too poor to produce a paying crop of corn, and he has not time to add the muck, he turns under the surface vegetation, and puts on a crop of rye, *always* accompanying this with the clover, and after one year's crop from this last, he never fails in a fair yield of corn. On a field thus treated, without any dressing of muck he got 27 bushels of corn per acre for the first crop, and after an interval of another season, obtained thirty-three bushels on the same land, showing a decided increase in the productiveness of the soil. A slight dressing of plaster is generally, though not always used, and never exceeds half a bushel to the acre. Mr. C. admits that more plaster might be useful; we think one to two bushels per acre would be applied with decided advantage, but it is purchased at a high price, about $10 per ton, and as economy and a self sustaining policy, has been a prominent principle in this system, this is all that has thus far been afforded. The muck would in all cases be a valuable remunerating addition, but this he has not always the time to give, and at the prices he has paid for his land, he can afford to leave it once in two or three years in clover, by which it is renovated, and for the present perhaps this may be the most judicious plan. As lands become dearer, however, which they are rapidly doing under this management, they being now worth $20 to $30 per acre, of no better quality than such as he bought a few years since at $8 to $12, the policy of manuring will become more expedient, though the rapidly improving nature of this system will give greater efficacy to the clover crop as a fertilizer.

It is surprising to see the elevated knolls and barren plains, that so lately exhibited nothing but a crawling sand, by the operations of the clover roots, in this otherwise impracticable material, gradually changing its inadhesive character to a firmly connected mass, showing a furrow slice that would gratify the most practised eye. Mr. Clark acknowledges his surprise at the facility with which the clover takes, and attributes it mainly to the use of the roller. We are inclined to concede much to that instrument, but think for his white and other clover he is greatly indebted to the plaster. Of this we have more to say hereafter.

We observed the wood-chucks, who are arrant epicures and gourmands in their selection of esculents, and especially of sweet and abundant clover fields, are thoroughly colonized over all the fields of Mr. C. They follow him, as our politicians do the successful candidate of executive dispensations, for John Randolph's seven principles, the five loaves and two fishes. They snuff his green patches of trefoils, and instanter abandon the poverty stricken fields of his unthrifty neighbors. His crop of wood-chucks, though not as important as the *shoe crop* at Lynn, may soon be well worth the harvesting.

Mr. C. has not pursued this cultivation sufficiently long to have matured a *system* of rotation, which, however, he virtually practises with some variations from his own judgment. A little more experience will enable him to determine, whether a crop can be taken more advantageously every second or every third year, but we are satisfied, with a moderate dressing for the corn, the rotation might be of three years' duration, affording alternately corn, rye, and clover, the last to be added entire *when dry* to the soil, for its improvement. Green crops are never used as improvers, they always being allowed to mature before turning under. Plaster should always be added, unless ashes or lime can be more economially applied; but the former is limited in supply, and the latter is to be had only at a price which will effectually prevent its use in this region.

Here, then, we have a *system* for reclaiming

* Digesting power.—Ed. Gaz.

barren wastes within every one's reach; costing nothing and yielding a great deal; and if this were rigidly carried into practice, how soon should we see the naked sand banks that exist to a greater or less extent, every where between the Alleghanies and the Atlantic, converted into verdant, luxuriant fields. Yet for the want of application and steady perseverance in this plain, straight forward, simple course, how many will continue to live on in ignorant poverty, when they might, with less toil, and the use of a moderate share of intelligence, have a competency. A single bar left down in this practice, lets in the whole herd of Pharaoh's lean kine. Without the roller and plaster you get no clover; if you cut off the clover when grown, you get no subsequent crop; or if you crop too closely or rapidly, the clover-bearing properties of the soil are exhausted, and new manures, or years of idle, wasteful fallow are necessary to resuscitate it; whereas, by a careful observance of the above plan, the ground is constantly and profitably at work, bearing its burthens on equitable shares, giving one half or two thirds to you, and reserving the remainder to itself, to enable it to continue the supply. Though Mr. C. does not connect any grazing or stock-feeding with these operations, it is easy to see how it can most advantageously and profitably be associated with them. Cattle and sheep can be put on to the rye fields both in fall and spring, when sufficiently thick and stout to justify it, and when well sodded over with clover, what more mutually advantageous to cattle and land, than such a co-partnership?

NOTICE OF THE APPOMATTOX COAL PITS.

For the Farmers' Register.

The following notes were collected during a short visit to that part of the coal field on the Appomattox river. Approaching the coal field from the river the land is undulating, the soil varying in color and texture as the underlying rock, granite or hornblende slate appears at the surface. The disintegration of the hornblende producing a red tenacious clay—whilst the soil derived from granite is gray and light. The hornblende slate which dips to the east can be traced to the verge or out-crop of the coal measures, which dip in the opposite direction. Commencing at Rowlett's pits, one mile from the river, the general direction of the strike or out-crop is about north 20° east. In this line, and 5 miles north of Rowlett's, are Coate's old pits, now the property of Mr. Hall of Petersburg. These are the two extreme points at which coal has been discovered on the Appomattox, and even at these the seam was found too thin and too much disturbed to admit of successful operations—the coal at Coate's old pits being but 2 feet thick. Hill's old pits are situated one mile south of Coate's; the seam here, which is about 5 feet thick, was worked 5 or 6 years and abandoned. These pits were opened about 20 years since, and it is but within the last 3 years that coal has been discovered at any intermediate point. To a person at all acquainted with the science of geology this must seem strange. The dip of any stratum being given, the strike or line of direction of the stratum is also known, being always at right angles with the dip. The pits were worked at or near the out-crop; the dip was of course known and the direction of the out-crop could be easily traced. The thickness of the seam at Hill's indicating too an increasing thickness towards the south.

At Clover Hill the coal approaches within a few feet of the surface, being covered by a thin diluvial stratum. The discovery of coal at this point in 1839 was followed up by Mr. Cox with energy and intelligence. The Clover Hill pits were sold one year after their discovery, by Mr. Cox, and are now the property of the Clover Hill Company. They are situated 2 miles south of Coate's pits and about 4 miles from the river.

At first the seam was worked immediately at the out-crop; this has been abandoned, and a shaft sunk to the depth of 240 feet, being the deepest on the Appomattox, and about 336 feet west of the out-crop. The dip of the coal at the out-crop is 45°, the difference between the distance from the out-crop and the depth of the shaft, the surface being nearly level, shows that the seam flattens off towards the centre of the field. The dip in the shaft is about 20°. For a section of the shaft, with an illustrative suite of specimens, much valuable information, and other civilities, I am indebted to Mr. Cox. The shaft passes through the usual coal measures, consisting of alternations of sandstones, slate, grit, coal, shale, &c. The organic remains found are few and imperfect, with the exception of some gigantic calamites, measuring 10 inches in diameter, and generally found in a vertical position, their lower extremities resting on glance coal. The substance of these calamites is often different from the rock in which they are imbedded, proving that they were first enclosed, and subsequently replaced by matter from above. The coal here is 14 feet thick, including 3 feet of slate; it is worked in two parallel drifts, connected at intervals. By means of the divisions in the shaft the ventilation is quite effective. The floor of the drifts, having a slight inclination towards the shaft, the loaded corves descend by their own gravitation, and when empty are drawn to each extremity by a mule. We were struck with the favorable appearance of every thing here. The drifts are well drained, the roof excellent, not indicating the slightest disturbance. It is impossible to contemplate, without feelings of pleasure, this vast store for the future comfort of our fellow beings. The coal measures here, as on James river, rest on a coarse porphyritic granite. The seam worked however is not immediately in contact with the granite; several feet of sandstone and perhaps another seam of coal being interposed.

Twenty-five men are employed, and it is thought that the coal raised during the present year will amount to 150,000 bushels. The raising of the coals as well as the draining of the pits is effected by means of a small steam engine. The raising of water by means of rope and bucket is a great waste of time and power, and has nothing whatever to recommend it, excepting its extreme simplicity.

Johnson and Moody's pit is located 100 yards from Cox's line, the seam being the same as that worked in the Clover Hill pit. The coal is similar in quality, but the shaft being sunk nearer the outcrop, the depth is only one hundred feet. 15 men are employed, and about 75,000 bushels is the amount of coal estimated for the current year.

In the drift towards the south in this pit the coal is completely cut off by an east and west dike. A number of these dikes are seen crossing the river, and at Battersea, near Petersburg, a remarkable one occurs, composed of globular basalt and wacke. These dikes can frequently be traced on the surface. This is the case with the dike in Johnson and Moody's pits; so that much useless labor and expense may be spared by a careful examination of the surface, at the out-crop, previous to the location of a shaft. It is probable that the greatest thickness of the stratum of coal will be found a little to the south of this pit.

The Appomattox Company, we were informed, have commenced a re-examination of the land near Rowlett's abandoned pits. It is to be hoped that the proprietors keep accurate surveys of the workings; the result of every exploration should also be carefully recorded, and deposited together with the survey for safe keeping, as valuable information for the benefit of posterity. For want of such precautions, in the early mining operations of England, subsequent enterprise has suffered extensive and frequently ruinous losses. It has often happened, that after the cost of sinking shafts, draining, &c., had been incurred, the parties concerned have had the mortification to find that the coal had already been worked and exhausted, a fact of which the surface presented no evidence.

The quantity of coal, if any left in, should also be noted; for although a seam of 2 feet may not at present pay the cost of working, yet the time may not be far distant when even this thickness would be considered valuable. Many of the mines worked in the coal districts of England do not exceed 2 feet in thickness. Of the increasing value of this deposite no doubt can be entertained. At present the small coal which amounts to one-fourth of the quantity raised, is allowed to accumulate at the pits, the cost of transportation being too great to admit of its removal. In countries where fuel is scarce, small coal is used extensively by those who cannot afford better. It is mixed with earthy and other matter, made into a paste, which is rolled into balls, and in this way makes a tolerably good fire. This small coal when converted into coke is a good substitute for anthracite or charcoal. The bulk of the coal is much increased by the operation of coking, and could be furnished at a much cheaper rate. The process of coking is neither difficult nor expensive—a large brick oven being all the apparatus required. The oven should be about 8 feet square, having an opening in the top, and one in front, furnished with an iron door through which the coal is introduced. The coal once ignited, combustion is allowed to proceed slowly, until all the bituminous matter is consumed. The coke is then broken, withdrawn from the oven by means of strong iron rakes, and extinguished. The heap of small coal at one of the yards at the basin, would furnish convenient material for such an experiment.

From the pits to the Appomattox, a distance of 5 miles, the coal is hauled in wagons over a road far from level. It is then brought down the river 20 miles to Petersburg, in boats carrying about 200 bushels. The cost of transportation amounting to 8½ cents a bushel. In Petersburg the coal is delivered to purchasers at the yard at 20 cents a bushel.

With a view to lessen the cost of transportation a survey for a rail-road along Winterpock creek, was made some time ago. Besides shortening the distance, this road would cut off one of the worst points in the navigation of the river, between Petersburg and the coal pit landing.

The road should not be an expensive one, as little grading would be required. This improvement will be made when the value of the Appomattox coal deposite is properly appreciated by this portion of Virginia. A small amount appropriated to the improvement of the Appomattox would be of incalculable benefit to the coal and other trade of the river. The boats suited to the navigation of the river in its present state require 3 men for the space of 2 days to bring down 200 bushels of coal. Shute navigation being the cheapest mode of improving a river, answers very well when time and labor are of little value, but where competition of any sort is to be met, it must be abandoned. Dams and locks—still water navigation—can alone satisfy the demands of commerce, on any river claiming the name of navigable, at the present day.

With these improvements, and a connexion between the basin, the river and the rail-roads, the Appomattox coal would no longer be confined to home consumption.

We returned from this excursion with a higher estimate than we had already formed of the many advantages enjoyed by the town of Petersburg: an inexhaustible deposite of coal, almost on the very banks of a navigable stream; building materials in abundance and of the very best quality; water power to any extent; the means of increasing the fertility of the soil a hundred fold, presented in the rich deposites of marl by which Petersburg is almost literally surrounded; a navigable river to her very doors, and rail-roads in every direction, ready to distribute the products of the industry and enterprise of her citizens.

M. TUOMEY.

MARSHY SOILS.

From Booth's Geological Survey of Delaware.

The richness of the marsh lands in the western and southern parts of Kent and on the ridge in Sussex has been a theme of admiration to all who have visited them. They are situated on the branches of the several streams, which having their sources in Delaware usually flow towards the Chesapeake, and which originating from rains and springs in the midst of extensive forests on a broad and very flat surface, with an argillaceous substratum impervious to water, and becoming clogged and dammed up by fallen trees, leaves and brushwood, naturally expand into broad basins, termed marshes. The luxuriant growth of trees, shrubs, and smaller plants, and their constant dilapidation and decay, in the shallow waters of the sluggish streams during the lapse of ages has generated a black vegetable mould, averaging three feet in depth, being rarely less than six inches and sometimes exceeding six feet, composed throughout of the same materials. It was not until the close of the past or within the present century that effectual means were resorted to for recovering this land from almost constant inundation, since which time nearly all the

great marshes have been drained by the excavation of ditches or more properly canals in the natural bed of the stream, and a large amount of the most fertile soil in the state brought under cultivation. One of these great drains increases from 12 to 24 feet in width from its source to its mouth, a distance of nine miles, and throws off a sufficient quantity of water in spring freshets to float a moderately sized vessel. The Colbeith, Cow, Herrington and Tappehanna marshes in the west of Kent county are the main feeders of the Choptank, and Marshy Hope in the south forms a main source of the North-west Fork river. The principal and several minor branches of the Nanticoke have been also subjected to drainage, beside many smaller streams in Sussex. When all the water-courses shall have been confined in a similar manner within their proper channels, a very large amount of an inexhaustibly fertile soil will be brought under the plough, and the noxious exhalations of marshy lands will cease to produce diseases to which their inundated state renders them subject.

When we examine the soil thus wrested from the waters, an unusual uniformity of composition appears to prevail in it; it is black, very unctuous to the touch in its moistened state, rarely so light and spongy as not to admit of grain after a little cultivation, becoming sufficiently compact on drying and consisting of decayed organic matter and argillaceous earth. The organic matter chiefly humus-coal, and humin, a little of the humic and crenic acids, and that it does not contain uncombined acids, such as the malic, acetic or phosphoric in quantity, is shown by its productiveness immediately after clearing. The fertility of these soils is shown from the fact that some fields have been tilled in corn for 40 years in succession, without an apparent diminution of their productiveness; but nevertheless the idea, which seems to have become deeply rooted in the minds of the people of our western states, that such land can never be exhausted, cannot be too soon refuted and exploded in Delaware. No soil, however rich, can withstand excessive tillage, except it receive an adequate return of its richness; an assertion to which the experience of ages will bear witness, and which will be confirmed by the experience of the west, ere 50 years shall have elapsed. The quantity of organic matter in some of the marshes is so great that during a dry season, the soil which was accidentally fired, continued to burn like coal, and could only be extinguished by rain. The remains of such fires have been observed in several instances, where the carbonaceous matter having been burned out, left the earthy constituents converted into a substance resembling brick by the heat of the fire. It is said that lime applied to this land has sometimes been found injurious. It may admit of a doubt whether the experiments were judiciously made, but supposing that to be the case, it must arise from the existence of too much humin, or the organic acids, which the addition of lime would bring into a too rapid action. The proper course to pursue with it would be to give a very light dressing of lime, which has been exposed to air for some time in order to its combination with carbonic acid, in which state it guarantees a gradual decomposition of insoluble vegetable matter, as shown. There is one important use which these soils may receive and it is only surprising that so little attention has been paid to it; the adjoining lands, sometimes argillaceous, are usually light sands, and if a portion of the black marsh soil were spread upon them, it would render them both more productive and cohesive, and surely there is in nearly every place where it occurs a superfluity which should not be suffered to lie unproductive.

Similarly formed to the marshy soils and arising in part from them, are those black deposites in the creeks and branches, existing in all parts of the state, but abounding in Sussex and Kent. They are largely composed of organic matter, but contain more earthy constituents than the preceding, and appear to be better elaborated, and prepared for use. In a majority of cases they may be directly applied to land without mixture, and will prove a very valuable substitute for manure of the organic kind, but if extracted where the tide flows, it will often be requisite to expose them to frost, or mingle them with lime, or submit them to both, prior to their employment. It is not merely in larger streams we are to look for this material, but in small branches, brooks and even in the courses of springs; it may be found on nearly every tract of land in the state, and more especially to the south. It is a source of fertility within the grasp, and certainly within the means of every citizen, and it only needs to be tried, fairly tried to gain it a lasting reputation as natural organic manure. Experiments have been made with it to a very limited extent, and although successful, it is surprising that its use has not extended; for in some instances, applied alone it has doubled a crop of corn in the first season, and exhibited good effects for many years; with lime it has produced similar results which will stand the test of a longer time. This vegetable soil is not always uniform in its composition, for although in creeks it is usually black, and earthy, yet in some small upland ponds or swamps it is brown, light and spongy. In the latter case in particular it should be employed in connection with lime in the caustic state, i. e. freshly slacked, to promote incipient decomposition, and to correct acidity, and even in all instances of its application, lime will benefit it and insure greater durability of action. Many farmers in Delaware, really desirous of improvement, know not where or how to commence, since they cannot raise one-fourth the quantity of manure requisite for restoring productiveness, and their farms are extensive. Here is a material, with which to make the first attempt; let them use it alone, and if it prove good, continue until means are obtained to employ lime in addition to it; if the result be not favorable alone, let it be carried to the barn-yard, to form a layer of it there, and when its surface has been covered by manure, let them bring in another layer, and in such a manner, the quantity of manure may be increased many fold, without deteriorating its quality.

From the upper part of the state to its southern boundary the Delaware river and bay, and the sea-coast are skirted by flat lands of varying breadth sometimes exceeding a mile, subject at times to inundation, consisting of a flat, and dark colored vegetable mould, clothed with a luxuriant growth of reeds and grasses. Supposing them to average a mile and a half in width through the whole length of the state, we would have about

100,000 acres of Delaware marshes, a large extent of land, which if it were brought under cultivation, would prove to be the richest land in the state. Its depth and richness of soil, and the ready means of restoring it when exhausted, are ample proofs of the assertion, but it may be reasonably doubted whether so great an undertaking as reclaiming this land at the present time would meet with an adequate return, when we consider its expense, the comparative paucity of population, and the imperfect system of agriculture pursued in the state. The successful execution of a small portion of the task in the upper county is ample evidence that the work is practicable, and the experience, which Holland has attained on this subject during ages, could be wielded in Delaware. But since it is not at all likely to be brought into execution for a long period of time, why may we not derive some benefit from these lands at the present time? Independently of the embankment of small tracts along the shore, and without reference to the grazing of cattle on these natural grass lands, the soil of the marshes may, and should be applied extensively as a manure on the upland. The embankment of ditches where they are not otherwise required, may be employed; or the marsh may be dug expressly with the view of employing the soil as a fertiliser, and it is such a vegetable mould which is chiefly required in Delaware to render it more fertile. The marshy deposite to which allusion was made, is variously composed, or more properly speaking, it is in different states of decomposition; being sometimes a black, unctuous matter, both vegetable and mineral, containing no traces of vegetable fibre, again a similar soil with fibre, and lastly a formation consisting chiefly of fibre or the undecayed roots and leaves of plants. The first of these is the most valuable, and may sometimes be directly applied to land without admixture, but it is advisable to adopt a uniform method of using it, which may be done in two ways, by mingling it with lime, better after exposure to the air for some time, or by drawing it into the barn-yard to bring it into an incipient fermentation by contact with stable manure. In either case it will more than repay its expense, and if lime be employed on the land at the same time a more powerful and durable influence will be derived from it. There is one kind of material bearing some connection with the preceding, a species of sea-weed, observed along the shore of the bay, but more remarkably constituted on the beach a few miles below Lewes, which will prove of great excellence, when brought to an incipient fermentation, as it contains much blue mud, and is penetrated, and inhabited by numberless shell-fish. It would become more useful if drawn into the barn-yard, and suffered to ferment in a slight degree, for the decomposing animal matter will bring the weed rapidly into a similar state.

There remains yet one other substance, which is easily obtained, and will repay the expense of its application to the soil. It is the "blue mud," which is constantly depositing from the river and bay, on the marsh lands under the circumstances pointed out in the paragraph referred to. The fertility of those lands of which it forms the upper surface, and its beneficial effects in the few instances in which it has been employed on the upland are a warrant of its fertilising powers, but it is a matter of some doubt to what substances its effects are mainly to be attributed. Its basis is a fat clay, both lead-colored and yellowish, with a quantity of organic matter, which appears to be chiefly in the state of crenic and apocrenic acids combined with the oxide of iron. There is no doubt that it would be advantageous if applied directly to the soil, but its tenacity is an objection to such a mode of using it, and hence it is more advisable either to draw it into the barn-yard, where it will be broken down and mingled with manure, or to mix it with lime, and expose it for some time to the air, adding at the same time the black marsh soil, which is generally to be obtained in its vicinity.

In the present section our attention has been devoted to a fertilising ingredient of a high order, which we have denominated "*Marshy Soil*," in order to embrace the several varieties under one head; in agricultural works it might be termed a *peaty* soil, but the term would not include all those which have been described, for the "blue mud" is wholly unlike a peaty soil, but being deposited on the river-marshes, it soon becomes a marshy soil, and many of the creek and western marsh deposites are far from being peaty, although they contain much organic matter. From a careful perusal of the section, it will be observed that this source of fertility is every where abundant, and in the two lower counties may be said to lie within the grasp of every farmer: let it not, therefore, as is too often the case, be disregarded or undervalued, for its abundance and convenience, but applied judiciously, frequently, and profusely. Its value rests not on a mere theoretic assertion, but it has received the test and sanction of experience, and such experience, both in Delaware and elsewhere, as may not be contradicted. As it would be a matter of nicety to discriminate between such varieties as are not sufficiently decomposed, and require some preparation prior to their application, and those which might be directly employed; it would be better to adopt a general rule relative to the mode of using it, viz., either to draw it into the barn-yard, or to form a compost with lime, or with ashes. In either case it will form an excellent manure, and with lime or ashes a durable one. It is indeed a fortunate circumstance that this valuable material is diffused in such abundance over the state, and not less gratifying that it is more widely distributed in Sussex and Kent counties, where the soil chiefly requires the addition of organic matter to restore it to its former fertility or even to excel it, and where it is of such a peculiarly light character as to require the use of precisely such a substance to render it more compact and tenacious, and more capable of repaying the expenditure of time, labor and materials, liberally bestowed upon it by the hand of industry and enterprise.

BONES.

It is said that in 1839, there were upwards of 30,000 tons of *bones* imported from foreign countries into Hull; and that in 1837, the value of the article imported into England, was nearly a million and a quarter of dollars. We remember to have seen a notice some months ago, of an exportation of bones from our own port, to Liver-

pool. Now is it possible that the enterprise and good judgment of our farmers will allow John Bull to carry our bones 3000 miles to spread upon his lands, and they themselves stand by, as if they thought them hardly worth the grinding! We are apprehensive that *bone dust* is not sufficiently appreciated in this vicinity, or the material would not be sent from our very elbows, to enrich the broad pastures of England.—*Farmers' Cabinet.*

ON THE CULTIVATION OF ARTIFICIAL GRASSES.

For the Farmers' Register.

Red clover.—On the proper culture of this grass, the very foundation of improved husbandry depends. To prepare the land suitably to sow this grass seed on, it must be frequently tilled, until the soil is in a fine mellow state, and the native grasses destroyed. The usual and best way on rich land is to sow the seed on wheat or rye in the month of March, in the latitude of Baltimore, the ground being previously cultivated in corn, then oats or barley, and then well manured for the wheat crop; then sow 6 to 8 quarts of clover seed to the acre. Something less seed may do when evenly sowed by an experienced, careful hand; but it is best to have seed enough sowed to completely cover the land, otherwise weeds come up in place of clover, exhausting instead of improving the land. But where manure is scarce, and the land rather poor, plough early in the season, and sow buckwheat, peas, corn or oats, to protect the land from the sun's rays, and smother weeds and grass, until a suitable time to plough these grasses in for the wheat crop; or if the ground is in order in time, say the 12th of July, sow buckwheat for a crop, and sow the clover seed at the same time. On sandy land clover frequently stands best if sowed the latter part of summer, and often does well with buckwheat, provided it is not sown two thick, or does not lodge. Also, where a corn crop is well cultivated, the ground in many cases may be got into such good order that the clover may be sown the last time it is cultivated, which may be done in August. And seeing clover is the great improver of land, and by it the land can be improved cheaper than in any other way, it ought to be exhausted as little as possible, in order that the clover may take, which if once well set, and suffered to remain on the ground without mowing or pasturing, and the second season's crop ploughed in, will often double or treble the wheat crop sowed on it, which is the cheapest plan of improving land, and of course the most important to every farmer, when improving a poor farm.

On rich land clover is apt to lodge; in this case it ought to be mowed for hay, to prevent its root from rotting. Most people handle clover hay too much, and expose it to dew and rain until all or many of the leaves are off, and until it looses all that delicious odor and sweetness so very acceptable to stock of all sorts. In good weather six hours' sun on it will cure it sufficient to go into the barn or stack. If water cannot be twisted out of the stems of clover, it will keep, and then the leaves and other nutritious qualities will be preserved. A peck of salt to each tun of hay would be an additional preservation, and the best way salt could be given to cattle. To save clover seed, mow the second crop as much above ground as will just cut all the clover heads, leaving as long a stubble as can be, to protect the root from injurious effects of the heaving spring frosts, which are apt to throw the clover roots out, if left too bare by mowing or pasturing. After the seed is mowed, leave it in swarth until wet with one or two rains, to rot the hull or chaff that contains the seed, otherwise it is very hard to thrash out. In many places they have clover seed mills to take out the seed, but persons having a good thrashing machine can get it out quite expeditiously; and it is a profitable crop at $5 per bushel. It is estimated one year with another that land that will produce 15 to 20 bushels of wheat will as certainly produce 4 to 5 bushels of clover seed per acre, quite as valuable, with much less labor than the wheat crop.

Timothy grass, called Herds-grass, in New England.—This is a valuable grass for hay, is very productive on clay loam, rather moist than dry. In newly cleared land, if well grubbed and all the leaves carefully raked and burnt, it will be best not to plough the ground, which would bury the mellow fertile surface soil, and bring up the stiff unproductive clay, but instead thereof scarify the surface well both ways, sow and harrow in the seed, then roll it well to make the surface compact; as there are often some remains of old rotted leaves which would be too porous without rolling for the young plants to live in. The land is much quicker got in order this way, on rooty new land, than by ploughing, and is much better for the above fibrous rooted crop, which requires fertility, but not deep tillage. The seed is best sown from the middle of August to the first of October, but about the middle of September is the best time. And in February and March, 6 quarts of seed carefully and evenly sowed will do. Orchard grass, white clover or green grass may be profitably mixed with timothy, especially if it is intended for pasture.

Orchard grass.—This grass is very productive of hay and pasture, it grows very quick, fit to mow when the clover is, and may very profitably be sown with it. It may be sown in the fall, with winter grain, or by itself; or in the spring with oats or barley. If sown in the spring on wheat it does well, but must be harrowed, as the seed is light and long, and would not get covered otherwise. When sowed alone it will require 1½ bushel of seed to the acre. ROBERT SINCLAIR.

Clairmount Nursery, near Baltimore.

PROCEEDINGS OF THE SOUTH-CAROLINA AGRICULTURAL SOCIETY.

From the Southern Agriculturist.

At a meeting of the South-Carolina Agricultural Society, held in Charleston, on the 22d July, 1842, the annexed preamble and resolutions were read by R. W. Roper, esq., vice-president of the society. After a mature consideration as to the prospective benefit to the state—the aid and utility to individual agriculturists, and the practicability of legislative aid, the following resolution was adopted:

Resolved, That the preamble, setting forth in

detail the merits of the question of an *Agricultural Survey of the State*, and the consequent resolutions, be addressed to the different agricultural societies of the state, requesting their opinion, and if consonant with their views relative to the same important object, their co-operation. The plan devised as the best, is for the various societies to petition the legislature at the ensuing session, or to submit the same to the General State Society who hold their meetings at Columbia, and request them to present the said petitions, and to lend their aid in conducting the same to a successful result. FRANCIS D. QUASH,

Corr. Secretary of So. Ca. Agr. Society.

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Mr. President :—I am desirous of enlisting the action of this society, in a measure of much importance to the prosperity of our state, in promoting the cause of agriculture. My design is, through its medium, to invite the attention of various agricultural societies throughout the state to the importance of effecting an agricultural survey of the parishes and districts of South-Carolina, and, by simultaneous petition to the Legislature, impart a probability of success. This subject was agitated in the legislature during the last session, introduced to their consideration by the recommendation of the governor, and, after very general discussion, the following resolutions, submitted by the committee on agriculture, were adopted :

Resolved, That an agricultural survey of the state of South-Carolina is highly expedient and necessary. That it will prove a means of developing and improving her resources—retaining at home her citizens and slave labor, and counteracting, in some measure, the effects of competition, in her great staple, from the fertility of new lands in other states.

2. *Resolved*, That the result of each year's survey be annually reported to this house, and copies distributed to every agricultural society throughout the state.

The following and last resolution, intended to give effect to the two preceding, was lost, viz.

Resolved, That the sum of $3,000 be appropriated for the ensuing year to said survey, and that the governor be specially charged with the selection of a capable person to execute the same.

A larger vote was taken in the house of representatives, in favor of these resolutions, than had ever before been known. It was asserted in the course of argument, that if a survey was desirable, it ought to be so intimated by some of the agricultural societies of the state, whereas no petition to that effect had emanated from any of them. This objection I propose to obviate, and show, that the agricultural community are fully awake to the important results that must spring from attention to this subject.

Some discrepancy of sentiments prevails among the advocates of survey, whether its character ought to be geological or agricultural. Both branches bear an analogy to each other. In effecting the accomplishment of the one, some light must be thrown upon the other ; but to produce practical available results, they must be pursued separately and distinctly.

A geological survey is confined to minerals, metals, rocks and earths, and by collateral association, sometimes may bear on agriculture. The geologist digs into the bowels of the earth for scientific investigation or hidden treasure ; the first involving antiquarian research—the last appertaining to commercial speculation, and requiring large capital.

The agricultural surveyor, in his investigation, seldom penetrates far below the surface of the soil, as his purpose is to examine its fructifying properties, which relate only so far to geology as the growth of a soil indicates its base and constituents. —Here the line of demarkation at once diverges, and the agricultural surveyor turns his attention to practical researches, in which he associates himself with the humblest tiller of the soil to aid with the light of science. Nature, in beneficence, has decreed that the earth shall put forth spontaneous productions for the welfare and food of man, but not to such extent as to impair the divine law, that from the sweat of his brow man shall eat his bread He receives the productions of the soil, only as the germ of what he is to improve, and by care and observation perfects its character and usefulness. The mass of mankind pursue their objects with as little labor as possible, and are content to travel in the beaten track marked out for them. Some independent spirits, gifted with investigating minds, escape this servile habit, and indulge their particular notions by experiments of their own ; but such laudable efforts are often doomed to disappointment, when, if aided by science, perfect light would be thrown on the investigation.

This fact may be illustrated by stating the utility of a system of rotation in crops. The exuvie of one set of roots is often pernicious to a plant of the same species, and stimulating to those of a different species. A soil is frequently said to be sour, which implies the existence of vegetable acids, operating on a plant in a manner which only science can account for. I once planted a field in cotton, which gave flattering promise till the bowls of the plant began to form, when they dropped in such abundance as materially to impair the produce. A field on a contiguous plantation was abandoned from a similar cause, the cotton being said to take the rust. A friend of mine, of high intelligence and enterprise, planted in rice, for ten years, a piece of swamp on Cooper river, (low down the river,) where the plant in its early stage was vigorous and promising, but about the period of jointing and the ear to swell, the stalk became attenuated, assumed a russet hue, and the crop always proved unproductive. This land is now abandoned, and the fine banks and ditches in destruction. How much time, expense and profit may have been made available, in these instances, by a judicious agricultural surveyor, who would have pointed out the peculiar diseases of the land and corrected the gradual decrease of always scanty crops ? In Massachusetts, H. S. Colman has doubled the value of some of the townships, by imparting to owners a knowledge of the properties of the soil they cultivated. In England and Scotland the agricultural chemist is applied to for that purpose, and he designates the manures and products most congenial to the soil, which saves expense and crude experiments. Recent discoveries have established the fact, that all soils contain an acid not hitherto suspected, called humic acid, from the Latin word *humus*, (earth,) and humin appears to

constitute a leading principle in all soils and manures; it is formed of carbon and hydrogen, and the humic acid of humin and oxygen. It combines with lime, potass and ammonia, in the form of humates, and the smallest portion of these will render it soluble in water, and fit to be taken up by the spongelets of the root fibres. Ignorance of the important action of this acid in dissolving earthy matters, puzzled old writers to discover how lime and potass got into plants. For these hints I am indebted to Edmund Ruffin, the highly talented surveyor of Virginia.*

A whole section of country may contain manures which science alone can render available, and the farmer go abroad for a supply of marl and lime, which scientific research would discover at home. Beds of limestone often lie with a horizontal inclination, and in a line of a few miles present to a farmer at one extremity of the line a quantity of limestone on the surface of the soil, which a farmer at another extremity of the line might suppose he did not possess, but which the agricultural surveyor would put him in possession of by instructing where to dig. But, in some instances, even the application of marl may be deleterious to soil, as where no putrescent or vegetable matter existed. This fact suggests the propriety of forming a knowledge of soils, and there does not yet exist in the science of agriculture a correct nomenclature of soils.

Many important duties appertain to an agricultural surveyor. The Massachusetts resolve, by which a surveyor was appointed, reads:—"To collect accurate information of the state and condition of the agriculture of the commonwealth, and every subject connected with it—point out the means of improvement, and make a detailed report thereof, with as much exactness as circumstances will admit."

The agricultural surveyor, therefore, visits every town in the state—every principal farm or plantation, the management of which promises to afford useful information, and corresponds and co-operates with practical men.

An agricultural survey relates to the nature of the soil, particularly in reference to the nature of the crops cultivated; to the climate, with reference to the growth of crops, number of acres cultivated, in what cultivated, the modes adopted, and the proceeds; to manures, to live stock of all kinds, as animals for pleasure, labor, food, for the dairy; to dairy produce—to poultry—diseases of domestic animals—bees—orchards—gardens—farm buildings—farming implements—and many miscellaneous subjects.

A letter from Henry Colman to Whitemarsh B. Seabrook, esq., dated 13th October, 1841, says, the agricultural survey of Massachusetts "has so far accomplished all that could have been reasonably expected from it. One of the most intelligent farmers of the state says, that it has already been worth three-hundred thousand dollars to the commonwealth. It has awakened a strong interest in the subject of agricultural improvement of the state. It has developed the agricultural resources of the state—has induced many farmers to keep an exact account of their husbandry, its expenses and returns, of which, before, they never had any estimate. It has led to many important experiments in agriculture. It has extended the knowledge of improvements made in any and every part of the state throughout the whole state. It has contributed, essentially, to elevate and better the condition of the laboring classes, and to render the agricultural profession respectable. It has sown seeds which must continue to be more and more productive for ages to come."

A letter from the same source, to the same gentleman, says, "An agricultural survey of South-Carolina would be of greater advantage than, perhaps, of any state in the union at this time, if so directed as to bring into proper notice the calcareous manures now almost entirely neglected, and induce your planters to use them. Such a result would be worth to South-Carolina more than the doubling the present productions and pecuniary value of the land of all that great region."

The statistical information of the agricultural surveyor disseminates a knowledge of each district, of the sums expended for supplies of whatever description, which at once leads to wholesome reflection and salutary change in a defective or losing policy. If, for instance, it can be shown, according to the recent letter of Mr. W. B. Seabrook to the members of the legislature, that if an increase of a quarter of a bushel to the acre in corn, to the whole amount of land cultivated, were grown, the necessity of a foreign supply would be prevented, the saving to the state, at an interest of $1\frac{1}{4}$ per cent. on the amount expended on this single article, equal to $250,000, would abundantly compensate an annual cost of survey till the whole state was surveyed; and when we add the cost of horses, mules, cattle, hogs, beef, pork, butter, lard, onions, potatoes, tubs, baskets, oats, peas, hay, and numerous other articles for which we are tributaries, and which we can produce at home, an annual saving to the state ought to be effected, to the cost of $3,000,000. Do we not see lime and hay forwarded by rail-road and the rivers to Columbia, Camden, and intermediate parts of the state?—the sight ought to suffuse the cheek, of every patriotic Carolinian, with the blush of shame. The time was, when our Congaree boats, loaded with corn, lay at our wharves, when we exported corn, and now the reverse is the case.

The depreciation of our staple produce cannot stand this outlay. The boundless fields and prairies of the west supply cotton from 2 to 4 cents cheaper in the lb. than we can, and Texas is now swelling the produce. We must, therefore, retrace our steps. The time has passed when it was more profitable to plant cotton than corn, and the superfluous wealth which enabled to buy what we ought now to produce, has gone to other lands. The Sea-islands, without competition in their staple, scarcely support themselves; and the production of rice is not 20,000 barrels greater now than were exported fifty years ago.

Wise laws may be passed, and political axioms

* Mr. Roper has given to us a title to which we have no legal right. It is true that we have both surveyed and reported very extensively, though but in part, on the agriculture of Virginia, but it has been done altogether without authority from the state, or remuneration from any source. We fear that it will be long before the legislature of Virginia will order an agricultural survey; though its whole expense would not equal one-fourth of the annual cost of legislating to sustain fraudulent banks.—Ed. F. R.

expressed; but it is attention to the soil which gives a population for the one to operate upon, or impart consequence to the other. The value of laws and political axioms may be called forth by particular objects spread over a waste of time, but the consequence of a successful culture of the earth incorporates itself with our daily necessities and transactions. In every stage of society, the most elevated or humble, it contributes to the food we eat, the raiment we put on, and the habitations in which we dwell. It contributes to individual consequence, and becomes the national prop. An agricultural survey will afford the best statistics of the country, not drawn from general, but individual observation—will bring congenial intellects into communion, or collision, and elucidate facts which must tend to individual happiness and general prosperity. Instead of ignorance and squalid want, you will enjoy education and comfort—instead of emigration, permanent residence—instead of deserted habitations and abandoned fields, where the owl hoots from the window, or the fox starts from the thicket, you will have fields smiling with verdure and crowned with golden harvests—"the desert will rejoice and blossom as the rose."

It behoves us, therefore, to be on the alert—to take time by the forelock, and see how we can retard our fall, or advance our prosperity. One of the means, I consider to be an agricultural survey of the state; I therefore invoke the aid of this society in effecting such a salutary purpose by originating a move on the subject—by transmitting circulars to the twenty-six agricultural societies of the state, requesting them to unite with this society in memorialising the legislature of our state to carry out this important aid to our advancement. In furtherance of the object, I offer the following resolutions:

1. *Resolved*, That an agricultural survey of the state of South-Carolina has become highly expedient, as tending to retain and advance the population and wealth of the state by promoting improvement in agricultural science—developing resources now hidden or neglected and requiring scientific aid to bring to light.

2. *Resolved*, That a petition be sent from this society to our next legislature, praying that measures be adopted for an agricultural survey of the state.

3. *Resolved*, That a circular be sent to every agricultural society in the state, proposing co-operation with the Agricultural Society of Charleston, in effecting this important purpose, by simultaneous petition to the legislature, praying them to take measures to effect so useful and desirable an object.

4. *Resolved*, That our corresponding secretary be charged with the carrying out the objects of the above resolve.

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THE FARMERS' REGISTER.

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EDMUND RUFFIN, EDITOR AND PROPRIETOR.

STEAM PLOUGH.

From the Albany Cultivator.

We find the following in the "Planter's Banner," a paper printed at Franklin, La. We cannot doubt that eventually the obstacles that have yet prevented the success of the steam plough will be overcome, and the cultivation of our rich and vast prairies effected mainly by its use. The grand difficulty so far has been, not to create the power, but to make power effective. When required to drag a great weight, it is found that the wheels of the engine will frequently slide on their circumference; this is sometimes seen on railroads. If Mr. Larkin has devised a way to *make the wheel stick*, the ploughs will follow as a matter of course. The failures in England and Scotland, have arisen from this source; and it has occurred to us while reading accounts of their experiments, that strong spikes of proper lengths on the outer surface of the engine wheels, by penetrating the earth, would secure their advance, when in motion.

"We had the pleasure," says the editor of the Banner, "at the recent election in this parish, of seeing Mr. Larkin's model of a steam plough in operation. There are two engines which are attached to a square frame, with a boiler between them. Each engine is attached to the draining wheels, which are set in motion something after the manner in which the paddle wheels of a steamboat are caused to turn. In front there are two guiding wheels, which are easily turned by means of a draw wheel. The ploughs are attached to the rear of the machine. This locomotive was set in motion by Mr. Larkin, in the presence of a large number of persons, and various opinions were expressed as to its probable success. We heard several intelligent planters say they were confident Mr. Larkin's invention would answer all his expectations. In the experiments that have hitherto been made in ploughing by steam, the great difficulty has been to find a fulcrum on which the power of the machine might act. The resistance of the ploughs in the earth has been found so great, that although the power was in the machine, still it had not a sufficient *prop* or *fulcrum* to act upon. Mr. Larkin has taken this difficulty into consideration, and he says he can overcome it. We sincerely trust he may."

POULTRY INQUIRIES.

From the Albany Cultivator.

An "Inquirer" has submitted to us a variety of queries in relation to poultry; the nature of which will be sufficiently indicated by the replies, without occupying a column by their insertion.

1. As to buildings, it matters not how cheap and simple the poultry house may be, if it is made to combine the qualities of security from vermin, ventilation in summer, and indeed at all times; and warmth in winter. We would not advise any farmer who does not intend to make the rearing of poultry an important part of his farm business, to make any expensive structures for their use.

2. Hens should not lay near those that are setting, or with them, as trouble will most assuredly ensue. If two hens wish to set together, shut one of them up for a few days and there will be no difficulty.

3. Boxes for hens to lay, or set in, are best when placed around the lower part or floor of the building, rather than in tiers above each other, as they will be less likely to interfere with each other. The front part of the boxes should be partially closed, as fowls on their nests dislike notice.

4. Hens might escape small vermin by having their nests on the ground, but eggs will rarely hatch well in that position. Straw or hay should form the nest.

5. The best preventive of vermin we have ever known, is a box of sand and ashes for them to dust themselves in at all seasons. We have never known fowls injured by vermin, that had access to such boxes; and if provided with these, and limestone gravel, they will be rarely troubled with the gapes. We have kept poultry for thirty years, and have never, to our knowledge, lost a fowl from this disease. We have little doubt, that where the premises occupied by poultry are once infested with vermin, removal will be useful; or a thorough cleansing and white-washing may be adopted.

9. We know of no way of preventing hens from laying where they please, unless by confining them to their houses or yards. An egg placed in a nest will frequently attract them to that spot, but not always. Fowls will, however, always do better with the same feeding, to run at large at all seasons, the coldest weather excepted, than if confined to houses or yards.

7. The Malay and the Molucca are the same, or with very slight variations. The Dorking, originated in Surry, England, is pure white, and is distinguished from all other varieties by having five toes on each foot. The Game breed of fowls is slender in form, and their eggs small, but their flesh is superior to all other kinds in richness and delicacy. Their pugnacious disposition is the great objection to this breed.

8. Breeding in and in affects fowls, as it does other animals, very injuriously; and a change of cocks occasionally, or as often as every second year, is necessary.

9. With the breeds of fowls commonly reared in Virginia, we are unacquainted, and know not whether the Dorking or Poland breeds exist there in purity or otherwise.

10. Eggs may be kept for a long time in salt; but eggs intended for setting, should always be as new as possible; keeping them in any method injures them for this purpose. Neither corn meal, bran, or sand, will preserve eggs as well as salt. Salt prevents that increase or variation of temperature that all these allow. Protection from atmospheric change, and a low temperature, are requisite for the keeping of eggs; and where salt

is used, a few inches of this material is all the covering necessary.

11. Sulphur is one of the best substances for freeing all animals from vermin, by feeding it to them occasionally. Although we have never known the slightest injury result from its use, excessive quantities might possibly prove hurtful, and they are certainly useless.

12. The common duck or mallard is the only variety that can be profitably reared, as all others appear less hardy, require more care, and being wilder, are more disposed to make their escape. We are not aware that the wild turkey has ever been crossed with the domestic one, or that a successful attempt has been made to domesticate them. Such attempts appear to be scorned equally by the wild turkey and the partridge.

ANOTHER HUMBUG EXPLODED.

From the Albany Cultivator.

From the English agricultural journals we perceive that much attention has been excited in the agricultural community of that country, by the introduction of a new clover, called the Bokhara clover, famous for its rapid growth, and the great amount of green food a small quantity of land sown with the seeds would produce. Quite a handsome speculation was going on in the seeds, when some specimens fell under the notice of the naturalist, Dr. Smith, who pronounced the plant to be the *Melilot alba*, or white Siberian melilot, commonly known as Buffalo or *sweet clover*, but in reality no clover at all. This plant had long been cultivated in gardens, and to some extent had been introduced into field culture on the continent ; but the benefits expected from its use have not been realized. In a memoir read before the French Agricultural Society, in 1788, by M. Thouin, it was strongly recommended, but on a large scale was not found to equal representations made from garden culture. It was found in France to bear four cuttings in a year ; but if not cut while young, the stems became woody and of little value.

This Bokhara clover, or melilot, was introduced into Pennsylvania, some two years since, and the fortunate possessors of the plant were driving a lucrative business in selling the seeds at the rate of one dollar a hundred, when its identity with *sweet clover* was detected by a lady, and the bubble of course has burst in this country as well as in Europe. A letter from Mr. Hepburn, in the August Agriculturist, details the process of identification.

We have frequently cautioned our farmers against indulging in extravagant or costly speculations in new things, or things that are called so. The caution to "prove all things and hold fast that which is good," is as applicable in agriculture, as in theology. The melilot is a valuable plant for some purposes, but it will not equal the representations made of it as a forage plant. It is not a clover, and the plant is not a new one ; and if any, with a knowledge of these facts, have disposed of the seeds as such, they have practised a gross deception or imposition. Melilot is the plant used to give the peculiar flavor and appearance to the celebrated Schabzieger cheese of Switzerland, and the Guyere cheese of France. The green plant is ground in a mill and mixed with the curd into a kind of paste, which is put into conical moulds to be dried and cured. Some farmers in Europe are in the habit of mixing it in small quantities with their hay. Its powerful aromatic smell imparts to the hay an agreeable flavor, which is evidently agreeable to animals. But as most of our readers have cultivated it in their gardens as sweet clover, there is no necessity of enlarging on its properties.

REPORT TO THE STATE BOARD OF AGRICULTURE.

ON THE FARMING OF ROCKBRIDGE COUNTY.

White Hall, June 21, 1842.

Edmund Ruffin, esq.—Sir—The letter which you did me the honor of addressing, as Corresponding Secretary of the Board of Agriculture, came to hand yesterday. I promptly respond to your call, so far as my limited information will serve. Being a farmer of only some eight years' standing, the greater part of which time has been spent in erecting suitable buildings to make farming pleasant, I have not been enabled to give that attention to the improvement of my farm which it so greatly needed ; the former proprietor having been fairly starved off, sought a home in the far west, leaving the premises in a galled condition, without a good building, save the body of a barn. The consequence was, when I purchased in 1834, I had to build a good farm-house, negro-houses, stabling, shed my barn, put up meat-house, dairy and hog-house, together with saw-mill, grist-mill and oil-mill, and plant out some 300 trees of select fruit. Thus, you will see, with a limited force and not a large capital, I have had much to attend to, without being enabled to give much time to the improvement of my land. I have not, however, been unobservant as to the general management of my neighbors, and with the additional light diffused from your excellent Register, the Albany Cultivator, and the Southern Planter, I flatter myself I have derived much useful information ; and I hope, should my life be spared a few years longer, to let my neighbors see that a free use of lime, with deep ploughing, and a proper rotation of crops, will in the end not only yield a very comfortable living for my family, but will be a source of revenue.

The general average of the wheat crop in the county of Rockbridge will be about 10 to 12 bushels. Many good farmers make 20, 25 and 30 bushels to the acre ; Major John Alexander, in the year 1839, had a few acres that reached as high as 40 or 42 bushels per acre, agreeably to his report to the Rockbridge Agricultural Society. This crop is, however, rarely obtained, and I might safely put down the average of our best farms at something like 20 bushels. My own crop for several years did not average more than 5 bushels. Last year I took much more pains in preparing my ground ; after fallowing, hauled on lime at the rate of about 40 bushels per acre, tongued in my wheat, after rolling heavily in lime, say 1 bushel of lime to three of wheat. The crop looks remarkably well, and good farmers say I will have at least 20 bushels per acre. The

straw is beautiful and bright, and I shall commence cutting about the 24th instant. Where I did not lime the land, and only rolled in lime, the crop will not exceed 10 bushels per acre.

The use of lime is not generally resorted to in our county. Col. T. A. Barclay, John Ruff, esq., Th. Willson, and a few others, are all that use it, and generally but sparingly, notwithstanding it could be made at a cost not much exceeding 6 cents per bushel in many parts of our county. Our farms, averaging from 200 to 300 acres, have all more or less waste timber, which is left to rot in the woods, that might be usefully applied in burning lime. Limestone abounds in all parts of our county; scarcely a farm that is destitute of it, and in many places it can be collected in great abundance on the top of the ground. I flatter myself the day is not far distant when it will be extensively used. My poor fields begin to attract the attention of many persons, and it gives me much pleasure to impart any information on the subject of liming of which I am possessed. With regard to the corn crop, the system of cultivation is pretty much the same all over the county. The land is generally broken up in the spring, in most cases not as deep as it should be, notwithstanding we have fine large horses and good ploughs. Still the impression is, that 3 or 4 inches is deep enough. Where the land is level, and not subject to wash, it is checked both ways, generally 3 by 4 feet, 3 or 4 grains in the hill, thinned to 2 or 3 in good land. On good land, planted in this way, 40, 50, 60, and as high as 75 bushels have been housed per acre. The general average I would set down on good land at 50 bushels per acre, medium at 30, and thin lands, generally badly worked, at 12 or 15 bushels. Oats is becoming a much more common crop than it was some years ago, and is found very convenient for quick feeding. Also mixed and ground with corn, half and half, it makes an excellent feed for work horses, and answers in place of rye, being mixed either with cut straw or hay. This crop in our valley is usually sown in March, and, like the corn crop, varies from 10 to 75 bushels per acre, agreeable to the quality of the land and mode of cultivation. Rye has not for several years done well with us, has been subject to rust and blight. This year the crop will be better than the usual average; the straw clean, and yield will be from 8 to 15 bushels per acre. This is a valuable grain for horse feed, and the straw, when bright, is very abundant and excellent for cutting short, and mixing with chopped rye, corn, oats, or any good meal. It is also a valuable crop for early pasture for colts and calves, and milch cattle, during an open winter. This crop is generally sown with us in the month of August, or first of September.

One dollar per bushel for wheat is perhaps rather over an average price; corn usually commands 50 cents per bushel, rye 62 to 75 cents, oats 25 to 42 cents, rarely reaching the latter price.

Irish potatoes generally cultivated for family use, and some farmers make them for their cows and hogs. Roots not extensively cultivated.

I would briefly remark, that the mercury for the last six years has not often fallen below zero, and when below, only for a few days. In summer it rises sometimes as high as 98 degrees. The general range in the heat of the day, for the months of June, July and August, is from 70 to 85 degrees. I have in cultivation the apricot, nectarine, prune, plum, peach of many varieties, different varieties of grape, with a fine young orchard of select fruit, (apple,) all of which bear well, with the exception of the apricot. Our spring months are too cold, and the fruit is generally knotty. The different varieties of cherries do well. I have also raised the melon to great perfection; they are, however, late in maturing. You have some advantage over us in winter with regard to climate, being of more uniform temperature. We are more liable to sudden changes at all seasons. I have known the mercury vary 50 degrees in 24 hours. This rarely or never happens with you. We have perhaps the finest watered country in the world— bubbling springs and rippling streams are to be met with in almost every direction. And notwithstanding our county is very rolling, and stony, and no where spread out into extensive meadow lands, yet almost every farm has its little piece of meadow, which is not unfrequently watered from the spring. Most of our meadows are watered, and where the supply of water is abundant, the land and grass are proportionably good. Consequently we abound in cattle, horses, sheep, &c. Cattle and horses are more generally raised than sheep or hogs. Of the two latter not a great number are sent to market. I would however remark, before leaving the subject of meadows, that good grass usually yields about 2 tons per acre, and is sold from the meadow at from $5 to $6 per load of 1 ton; after being housed will command $7 to $10 per ton, owing to the supply. I might also remark, with regard to our grain crops, they are nearly always housed, and the grain got out during the winter months. There will perhaps be some change with regard to the latter practice, as we have now many good thrashing machines; no doubt much grain will be got out from the field, and particularly this year, as we are, in general with the people of our good old commonwealth, a good deal in debt. And now for the meadows, again. Grass, when much mixed with clover, is often cut in June, is permitted to wilt in the swarth, and if the weather is very favorable, put in cock on the second day; if to be put in large bulk, should remain in cock several days. Should then be opened, suffered to get well aired, and may be put away in any quantity. One peck of salt sprinkled on each load of 1 ton will add to its preservation, and the cattle or horses will eat it with great relish. A good hand will mow an acre of heavy grass per day, if not too much tangled.

With regard to dairy management, there has been so much written and said, that I despair of adding any thing to the stock of knowledge on that subject. I can truly say that, under Mrs. Jones' management, we have butter as sweet as a nut, and in the fall as yellow as gold, and that her butter was thought worthy of a premium at our last agricultural fair. As her course is simple, and easily put in practice, I will briefly state it. First, have good cows that milk rich; second, have good grass and good water and shade in your fields. May and June, on blue grass, are excellent months for butter; but September and October, when the cows are turned in on the meadows, I think best, the nights being longer and the weather more cool. Have a good spring house, and plenty of pans or crocks; let every thing be kept perfectly clean, and the crocks or pans al-

ways scalded when emptied, and put on a shelf to be well aired and kept sweet. Churn the cream with what are termed strippings, the last milk taken from the cow, from half a pint to a pint; put no hot water in the churn, but churn the cream and strippings till the butter appears. Separate it from the milk, and wash the butter in pure clean spring water, till the water (being frequently changed) is perfectly clear. The butter should be washed with a small wooden ladle, and not cut with the edge of the ladle, but thoroughly worked and pressed until all the milk is out, and the butter looks smooth. You may now salt to suit the palate, of good, dry, fine salt. Some persons work it a second time, but we have never found this necessary, if the duty is properly performed at first.

And now, my dear sir, I have scribbled you two sheets without any order; if you should think what I have written worth any thing, make such use of it as you like. I would be glad to render any aid in my power to the agricultural community of our state, and if my ability was equal to my will, I would make every part of the Old Dominion to bloom and blossom as the rose. Should you publish any of my remarks, please put them in proper order, and correct blunders. I had intended saying something on the subject of our fencing, but have not space except for a word. The fences of our valley are generally the worm, stake and ridered fence, with now and then a fence of three foot worm, with locust or cedar posts and caps. There is no post worth putting in the ground except cedar, mulberry or locust. These well set with chestnut rails make an excellent fence, which will last many years. Yours, &c.

HENRY B. JONES.

ARTIFICIAL MANURES.

From the Albany Cultivator.

The preparation and use of manures constitutes one of the points in which the advance of modern agriculture is most apparent. For this advance, we are indebted to the application of chemical science to an investigation of the substances most commonly used to promote the growth of plants. An imitation of the operations of nature has thus been effected, in which there has been a decided improvement on the original, as the change necessary to convert organic matter into the fertilizing material is effected in a very short time; the bulk diminished while the efficiency is increased; and the disgusting, offensive character belonging to some of the original compounds entirely done away. Substances, too, once wasted, or rather considered of no value, are now in the course of a few weeks converted into manures of the first quality. Every discovery of this kind is of importance to the agriculturist; for although some of them it is probable will not be made useful on a large scale, and some of the preparations cannot become common in this country; still there are many which we are confident will be extensively used every where; and the better they are known, the more highly appreciated by the farmer or gardener.

Poudrette, or prepared night soil, is one of the most valuable of these prepared manures, concentrating in a great degree the elements of fertility; and as prepared, being easily portable, used with facility, perfectly inoffensive, and very powerful in its action. The two most extensive manufactories of this article are the New-York Poudrette Company—D. K. Minor, agent, New-York city; and the Lodi Poudrette Company, at Hackensack, New-Jersey—A. Dey, New-York city, agent. We are pleased to learn that the demand for the products of these manufactories is constantly increasing, and the proofs of the value of the manure so made rapidly accumulating. The value of poudrette, compared with good stable or barn yard manure, is estimated as one of the former to from 12 to 15 of the latter; and some have even estimated the difference as still greater. When we remember that this manufacture is designed to convert what has always been a nuisance and source of multiplied diseases in our cities into a means of fertility and wealth, its importance will be duly estimated.

Another preparation, which is receiving some favor, is that produced by Bommer's patent, in which all ligneous or woody plants, such as straw, cornstalks, weeds, roots, sea grass, and in fact all vegetable matters, are converted into manure in a much shorter period than by the usual course of decomposition. It is pronounced as efficient as stable manure, more lasting, and costing but little. The process of preparing this manure has nothing difficult about it, and is said to be easily and expeditiously performed. It is probable the patent will for a time, even were its value unquestioned, prevent the extensive use which this mode of preparing vegetable matter might otherwise have obtained. Of the peculiar forms of the process we know nothing; but the testimony in its favor from those who have tried it, appears ample. Patent manures, patent implements, and patent medicines, are very apt, however, by practical farmers, to be placed in the same category.

The English agricultural journals have within the past year frequently alluded to the qualities of a new fertilizing preparation called Daniel's patent manure. The specifications of the patent have been received in this country; and though evidently intended to mystify, rather than disclose the real process of making the manure, it is easy to see that a powerful manure must be the result of the combination. According to the specification, the materials of the manure are divided into three classes. First: ligneous matters, peat, straw, weeds, &c. Second: bituminous matters; such as mineral coal (bituminous doubtless) asphaltum, pitch made from coal tar, or other pitch, mineral rosin, and also tar. Third: animal matter; such as butcher's offal, graves, flesh of dead animals, also fish.

The ligneous matters are reduced to powder by grinding, or by the action of caustic lime. The bituminous matters are also ground into powder; if sticky like pitch, a small quantity of dry quick lime is added to prevent adhesion to the machine; if liquid, they are converted into vapor by dry distillation, in which vapor the ligneous materials are saturated; or if preferred, the soft bituminous matters are dissolved in water, to which caustic alkali has been added, and in this the ligneous matters are steeped. The animal matters are mixed with the ligneous and bituminous ones, and then the whole reduced to a powder.

Such a preparation cannot fail to be a fertilizer

of the most powerful kind, though it is evident the process needs much simplification before it can be adapted to the use of farmers generally.

Guano is probably the most powerful natural manure known; and the artificial one that shall most nearly resemble that, will doubtless be the most valuable. Voelckel's analysis, the latest and best of this substance, as given by Dr. Dana in his Muck Manual, shows that it contains in the various salts of ammonia 32 parts in 100, sulphates of potash, and soda 9 parts, phosphate of lime 14 parts, soluble geine or humus 12 parts, and insoluble undetermined organic matter 20 parts. The artificial manures are valuable in proportion as they furnish the materials for the ammonia, phosphates, and sulphates, which abound in guano. It is likely, indeed certain, that the immense masses of guano existing on the islands of the Pacific, are in a very different chemical condition from what they were when first deposited by the sea fowl that frequent those coasts and islands; consequently, in no fresh manures, in any country, can we expect to find the same combination of fertilizing substances as in guano. In no other country could such masses have remained without the wasting or dissipation of their most valuable parts, or their entire substance; the nearly total absence of rain in the guano region preventing such a result. The guano is therefore not only the result of the accumulation, but the chemical combinations of ages, and what agriculture requires of science, is the discovery of the means of effecting in a short time what nature has been centuries in performing.

In all preparations of artificial manures two conditions are requisite; first, value as a fertilizer; and second, facility and simplicity of preparation. Without the first, the labor of manufacture is lost; without the second, few farmers will be able to avail themselves of the benefits such manures offer. Thus far, we are inclined to the belief that of all the artificial manures, poudrette best fulfils these two conditions; but it by no means follows that other combinations may not be discovered, equally simple, and more powerful. Of one thing we may be assured; all such preparations, when brought within his reach and his means, will be hailed by the farmer with pleasure.

ANSWERS TO QUERIES OF THE BOARD OF AGRICULTURE.

WITH REFERENCE TO PART OF NANSEMOND COUNTY.

Chuckatuck, Nansemond county,
July 4th, 1842.

Edmund Ruffin, esq.—*Sir*—These imperfect answers to the Queries of the Board of Agriculture, I now forward to you, agreeably to your request, received some time since.

I. "*Geographical state?*" *Answer.*—This part of the county (the west side of the Nansemond river) may properly be termed level land, though near the river and creeks somewhat broken.

2*d.* "*Climate?*" About as Norfolk, being only about 30 miles distant.

3*d.* "*Surface and soil?*" Rather shallow a few miles off the river and creeks, from 2 to 4 inches; on or near the margin of the river and creeks, it will vary from 4 to 8 inches deep. Sand largely predominates.

4*th.* "*Minerals?*" None but marl; nearly every water course and ravine has a bountiful supply, and that of the very best quality—sometimes mixed with clay, but with sand most generally. Some of the beds are very full of large shells, others smaller; whilst a third class somewhat resembles meal bran, and when fully dry becomes white. The farmers in this section are rather cautious with the use of it; it is found to be a great promoter of the growth of wire grass, and also to have injured the corn crop. No doubt but the latter is entirely owing to their ignorance of its strength, and the proper quantity to be used. When judiciously applied, there can be no question of its value. Red and white clover both very fond of it.

5*th.* "*Water?*" Most of the creeks as well as the river are navigable for small vessels drawing from 3 to 7 feet water. Water salt. Fish, oysters and crabs can be had at almost any time.

II.—"*General management of land.*" 1*st.* "*Quantity of arable land?*" The farms vary in size, say from 50 to 400 acres of open land; of meadow none, except the marshes and bottom lands on the river and creeks. Of wood generally very plenty; waste land some.

2*d.* "*Size of farms?*" As it is the practice in this neighborhood to cultivate say from a third to a half of all the open land every year, of course the farm for the year will vary from 25 to 200 acres in corn—the balance in oats, clover, or at rest, but not pastured.

3*d.* "*Rotation of crops?*" Answered above.

4*th.* "*Depth and manner of ploughing?*" From 3 to 6 inches; done mostly with a single horse, and sometimes with a pair, or a pair of oxen. Mules not much in use with us, as wheat is not cultivated. The ploughing is commenced about the first of February.

5*th.* "*Tillage of crops?*" Oats being first, are usually sown on the last year's corn land, and [the seed] ploughed in. Some few persons first flush the land, then sow and harrow in; if clover is sown, they also roll, which finishes the work well. This work is usually done about the first of March. Land intended for the corn crop is fallowed, then checked off at various distances, the extremes each way 2½ by 5½ feet, then all the intermediate, according to fancy. Some few persons drill their corn. The above practices cannot be new to any farmer; nor can I say any thing relative to the after management that is new. On and near the water courses are cultivated, for sale, the Irish and sweet potatoes, water melons, onions, pumpkins, and a few other vegetables; also cherries, apples, pears and peaches, with some other small fruit, the greater part of which are sold to vessels that trade out of our waters to northern markets. The apple, water-melon and sweet potato trade is quite a large one.

III. "*Products and prices of crops.*" 1*st.* "*Usual product,*" *&c.?* Of corn, per acre, the average about 20 bushels, though some farms on the river will do better. Oats, I am not prepared to say what quantity, as they are mostly consumed on the farm. The general selling price of corn is hard to state: at present it is worth and sells at 60 cents per bushel; oats about 33 cents per bushel; blade fodder usually about $1 per 100

pounds; sweet potatoes, first digging, 60 to 62 cents for 62 pounds, which is the potato bushel. This early in September—later, less price, but never below 25 cents per 62 pounds. Water melons usually commence at $5 to $6 per 100; apples, the first, 50 cents per bushel, and never less than 20 cents. The black-eye pea is also a sale crop. They usually sell at from $1 to 1.25 per bushel. Other varieties mostly consumed on the farm. The farmers in this neighborhood are generally able to get the highest northern market price for all their grain, when it is in demand.

IV. "*Implements?*" We use mostly the Free-born cast plough, for first ploughing. When the land is well broken, then the trowel or fluke hoe, and also a home-made cultivator, which does beautiful work when the land is in order to receive it.

V. "*Fencing and enclosing?*" The common worm fence is almost entirely used. Several farmers each have a cedar brush fence several hundred yards long, which is thought well of, after the following manner. First dig a ditch, 4 feet wide, 2 to 3 feet deep, carefully throwing all the dirt on one side, forming a ridge. Second, driving small posts or stakes in the bank, about 2 feet apart, leaving them 3 feet out of the ground. Third, then putting in the large brush of cedar, or any other lasting wood. Fourth, finish off with a binding; this I cannot describe well. The above fence, done well, is handsome, strong and durable; there is no blowing down, or stock breaking in.

VII. "*Grass and grazing.*" Answered in II. Also water, answered in II.

3*d*. "*Mowing and hay.*" Very little done.

4*th*. "*Artificial grasses.*" Red clover being the only one that is cultivated. Very little cut—being grazed off.

VIII. "*Live stock.*" 1*st*. "*Teams or laboring animals.*" Horses are mostly used; some mules and oxen.

2*d*. *Animals raised for sale or farm use?*" Oxen and a few horses; pork for home consumption, with a little for market. Also calves and lambs.

3*d*. "*Prevalent diseases, and their remedies?*" Inattention and starvation—remedies proposed, food and care.

IX. "*Dairy management?*" Very little.

XI. "*New or recent processes or improved practices in agriculture?*" Nothing to say, only a little more industry and management, which of late, I am confident, have taken root, and, I trust, in good soil and not stony.

XII. "*Obstacles to improvement, &c.?*" Nothing to say, only industry wanting.

XIII. "*Miscellaneous, &c.?*" Keep out of debt; strike hands with no man; stay at home; eat your own bread and meat, that which you make on your own estate; go not too often to either the hotel or the banks; be content with your lot or situation, be it never so homely; instruct your representatives to let agriculture and domestic affairs alone, and to make fewer and shorter speeches, and not talk so much about the "*dear people*," and their rights, at the same time caring nothing about them, after having received their votes, &c. J. Bunch.

STORING SMALL GRAIN.

From the Albany Cultivator.

You in the east, who have large barns and granaries, and convenient saw mills and lumber yards, cannot conceive the difficulty that you might encounter when settled on a new farm, in the west, forty miles from a saw mill. How would you store a few hundred, or a few thousand bushels of thrashed grain? Easy enough, if you only knew how—so could Careless have sealed his letter, if he had only known *how*. I will tell you how, and when you emigrate to the west, don't forget. Take fence rails and lay down a floor, a little from the ground, and build up the sides by notching straight rails, so they will be steady, and then take fine straw or hay, and tramp a layer smooth upon the floor, and caulk the cracks between the rails, and pour in the grain, and stack some straw over the top to keep out the rain, and your grain will keep better than in a close granary, and not waste a bushel in a hundred.

Buckwheat may be thrashed upon just such a rail pen, covered over with rails, much better than upon the ground; the grain falling through the rails into the pen below. Solon Robinson.

EXPERIMENTS WITH MANURES.

From the Albany Cultivator.

The following details of experiments made on the lands of Knock, near Largs, in the spring and summer of 1841, by Mr. Wilson, were furnished to the Philosophical Society of Glasgow. A piece of three year old pasture, of uniform quality, of about 200 falls, old Scotch measure, was divided into ten equal lots, which, treated as follows, produced the undermentioned quantities of well made hay:

Lot.	Produce per lot, lbs.	Rate per acre, lbs.	Increase per acre, lbs.
1. Left untouched,	422	3360	
2. 2½ bbls. of Irish quick lime added,	602	4816	1456
3. 20 cwt. lime from gas works,	651	5208	1848
4. 4½ cwt. wood charcoal powder	665	5320	1960
5. 2 bushels of bone dust,	593	5544	2184
6. 18 lbs. of nitrate of potash,	742	5936	2576
7. 20 lbs. of nitrate of soda,	784	6272	2912
8. 2½ bolls of soot,	819	6552	3192
9. 28 lbs. of sul. of ammonia,	874	6776	3416
10. 100 gallons of ammoniacal liquor, from gas works at 5 degrees of Tweddle's hydrometer,	945	7560	4200

The value of the applications was 5*s*. for each lot, or at the rate of £2 per acre. All the articles were applied on the 15th of April, 1841, and the grass cut and made into hay in the following month of July.

IMPROVED AGRICULTURE.

At the late meeting at Bristol of the British Royal Agricultural Society, Mr. Smith of Deanston, the author as he may be called of the improved system of thorough draining and subsoil ploughing, was called upon to explain at large his views and practice in a public lecture. This was done without writing, and has been reported at large in the agricultural press. We have condensed it from the Mark Lane Express, but have taken care to omit nothing that is essential to a full understanding of the subject. It is full of important matter, and will be read by every intelligent farmer with the deepest interest. The results of this system are beneficial in the most extraordinary degree, and bid fair almost to revolutionize the husbandry of Great Britain. The results are not more extraordinary than they are profitable, as it appears from the most undoubted facts, that while under the old system, a Scotch acre of land in a lease of 18 years, would after paying all the expenses of cultivation and rent, leave a profit of only £5 14s. sterling, for the whole time, and at the same time the quality of the land become deteriorated; under the improved system, the land itself would be left in a highly ameliorating condition, and the actual profits for the same time, after expenses were paid, would be £64 14s. sterling.—*Ed. N. G. F.*

LECTURE BY MR. SMITH, OF DEANSTON, ON DRAINAGE.

Delivered before the Members of the Royal Agricultural Society, in the theatre of the Philosophical Institution, Bristol, Wednesday, July 13, 1842.

From the Bristol Mercury.

After apologizing for the alteration of the time of lecturing, Mr. Smith proceeded:

The dryness of land is of great importance—in fact, the dry condition of the soil is the foundation of all good husbandry. It is beneficial to the working of the soil; to the after-growth of plants. There is scarcely any labor of agriculture which is not facilitated by the dryness of the soil. If we find a tree stronger than his neighbor, we shall find that there the soil is deep and in a dry condition. If we see a stronger and darker colored herbage growing on the hill side, there the soil will be found deep, and in a dry condition. There is not one of the various soils of the United Kingdom which will not be much improved by being placed in a dry condition, if they are not so by nature. Even on a subsoil of gravel or sand, the introduction of the thorough drain system would be beneficial; but as there is only a small portion of that sort of soil in this country, the greater part being super-imposed upon a wet soil, it becomes of the first importance to improvement in agriculture, that means be taken to render the soil dry. Many attempts have been made with that view, but until the introduction of the thorough drain system, there was not the power of draining land, on whatever subsoil resting, and rendering it completely dry. The purpose of this lecture is to illustrate the principles on which this system acts; then, to show the advantages in carrying on the different processes with respect to the various crops; and then to explain the modes employed to render this drainage effective.

[Mr. Smith here illustrated, by a diagram, his method of thorough draining; the soil, the subsoil, the drains, &c., being represented.]

In referring to two lines, representing the direction of drains, he had drawn one at a greater inclination than the other, to show the advantage of making the drains deeper than they generally were. The prevailing practice was to make the drains two feet deep, but he preferred an additional six inches—it was of great importance to allow the water to go off as quickly as possible, and this advantage was secured by cutting the drain to a greater declination. People suppose that at a great depth water would not go off at all, but this was a mistake. Another advantage from a deep drain was that it allowed the whole bank of soil to become completely dry, and it consequently required a very heavy rain to wet it. The action of the atmosphere too required to be taken into account. He would not enter upon the chemical question, but *it was well known that soils were much improved by the action of the air, and this advantage could only be secured after the water was withdrawn.*

To render the field completely dry, a great number of drains should be cut, and they should be laid off in parallel lines beginning at the highest side of the field. This secures a thorough drying. When the lines run parallel, much greater effect is produced than when they are drawn across. When drawn across, the drains may catch the water, but it does not run off so readily.

The distance at which the drains should be placed will depend on the soil. If the field has been subsoiled, the plough will form artificial channels in the soil below. If it is a stiff soil, it will keep long upon the surface; the more free the soil is, the greater tendency it has to allow the water to pass: so that on a stiff soil, such as the stiffer clays, taking into account the nature of the subsoil and the soil itself, about the same drain, will serve on all soils. The distances are generally from 15 to 20 feet: in some soils individuals have put in the drains at 12 feet; but that is, in some degree, throwing away money. From observations which I have made myself on all sorts of soil, I recommend about 16 to 20 feet as the distance from one drain to the other.

The way I usually proceed in draining is, first, to find a good bottom-level to run the drain into. In some parts of the country there is difficulty in getting an open level to carry off the whole water of the district, but by a proper engineering it may be accomplished in most situations: because it is found that if proper channels are executed, a larger quantity of water will be discharged with a very small fall. In an endeavor to carry off water, I found that in a drop of four inches in a mile, thirty feet wide and six feet deep, I could discharge 300 tons of water per minute: which is much more than would fall in a very extensive district indeed. So that if means be taken to carry off the main level, a fall may be had.

I should make the great main drain, if possible, about four feet deep—three feet six inches will do; but in order to have a drop from the one drain into the other, I make the main drain four feet deep, the receiving drain three feet deep, and the parallel drains two feet six inches. When there is any

rise in the ground, or any hollows over which the water cannot very well flow, it is necessary to make a cad's drain. That should be made about six inches deeper than the other drains which fall into it; then running on, it discharges itself into the main drain.

As to the manner of executing the drains, various modes are recommended, and on looking to land which has been drained a great many years, where the draining has been performed carefully, all the different modes employed for the purpose of keeping the drains open have been effective. A great deal of the want of effect in the duration of drains has been owing to bad execution. In some instances fagots have been introduced for the purpose of preserving the openings of the drain, and these have been found to continue and to preserve the openings in a perfect state for nine —in some instances, for twenty years.

In Scotland the peat-top is frequently used to form the tiles for drains. It does well in clays which are pretty stiff, but not so well in softer soils. In some sandy soils, the sides not being sufficient to resist the pressure of the top, the tile gradually sinks down and closes up the drain.

Another mode of filling drains is by stones broken into the usual size for making roads. Much has been said against the use of this sort of filling but when properly executed, the work is as durable as can be required. Where stone can be had, and tiles are expensive, I should prefer it to the tiles; it prevents any vermin from travelling in the openings of the drain, such as rats and mice, which do a great deal of mischief. The great point is, to be careful in covering over at the tops. As soon as wet comes, the sand and other materials sifts down into the stones, and they are choked up. I have found drains carefully executed completely destroyed in the course of a couple of years. If drains are so packed that the water falls down on both sides, the parts over-lapping each other, there is no opening whatever for the sand to find its way down. If drains are carefully cleared in this manner, I will warrant their duration for almost any period of time. I have executed myself about 130 miles of drain in this way, and have had them all filled with stones; many of them have been done 15 years, and there has not been a single instance of failure.

A gentleman in the theatre inquired the nature of the soil in the case alluded to.

Mr. Smith replied, both on a gravel and a clay soil. Many persons have asked whether or not the drains would be choked up in particular positions. I have always asked them what position they referred to, and have opened it up that they may see; and in no instance have I found a single drain choked up. I have the drains of 100 acres all discharged into one pond, provided for the purpose of seeing how much deposite came from the drain; and although we have had heavy rain, I have never seen the water in the pond tinged as if there was much soil in it. I can, therefore, safely recommend stones as a sufficient drainage: and in many parts of the country it is much cheaper than tiles.

The next filling used for preserving the opening of drains is the drain-tile. These are usually made of clay, and burnt. They are very handy and useful; and where stones are not to be had they are to be preferred. But there are districts where the clay-tile cannot be procured at any reasonable price. Lord James Hay has recently discovered a method of making them of concrete stones cemented by lime; in most instances they will come considerably cheaper than the brick-tile, and, if executed on the ground, where they will not have to be carried far, the breakage will be found to be very little, and they will prove to be durable. The cement made of lime is more lasting when covered up than if exposed to the atmosphere.

There are two other modes of making drains—peat-earth has been cut into a shape somewhat like a hollow wedge; and a sort of instrument has been made for the purpose of cutting peat-earth into the form of the tile, so as to produce an opening not liable to the objection of the wedge, which frequently sinks and pulls up the opening. A stone is frequently used to lay the concrete tile upon, and prevent its sinking. It is also made of concrete.

Many persons have expressed the opinion that, in some of the very stiff clays, drains of this sort would not be efficacious, and that the application of the subsoil plough after the draining would have no good effect. With the view of showing the beneficial results, both of draining and subsoiling, I have brought some specimens, of different clays, in order to show what improvement can be made. Here is a piece from the Pass of Stirling. This kind of soil has been cultivated from a subsoil, and has been known to produce excellent crops of Swedish turnips. Here is another very hard clay from Yorkshire.

A gentleman inquired how long after the subsoiling the land assumed a different character.

Mr. Smith—almost immediately—in the very first year. It requires some years before it becomes adapted for a turnip soil. I have a specimen of some soil which twenty years ago was so extremely stiff from the alluvial deposite in the Pass of Stirling, that it required to be broken with large mallets, to reduce, mechanically, the great lumps of soil. Thorough draining or subsoiling was never thought of till about twenty years ago, when this land was first drained; and now they get from it splendid crops of turnips, and in almost any season.

A gentleman wished to be informed of the nature of the soil in Mr. Smith's farm.

Mr. Smith—It varies. In some parts it is sandy clay, and in others, clay perfectly impervious to water. *When I first began to subsoil there was not more than three or four inches of active soil properly so called, for growing plants: after a labor of about fifteen years I have now an active soil of sixteen inches, and can turn over that now in any part of the farm.*

How near are the drains in order to produce that result?

Mr. Smith—Twenty feet. I think a distance of about eighteen or twenty feet from drain to drain is a proper distance for almost any subsoil. I shall now proceed to detail the application of the subsoil plough.

When I began to cultivate my own farm, although I had put in the drains, I found they were not so efficacious as expected, and I then began to think of stirring up the subsoil, which gave rise to the idea of the subsoil plough. I thought I must construct an instrument which

would execute the work with the least possible power. I made my plough strong, and of that form to which the least resistance would be opposed, at the same time taking care to have sufficient power fairly to stir up the soil.

I will here explain the principle of the subsoil plough. The great principle is, that there are many subsoils, which, though capable of being converted into a good soil, yet if brought up and mixed with the active soil, will so far deteriorate it as to make it for some time sterile. The great point is to stir up the subsoil, still retaining the good soil on the surface. Stirring up the subsoil would, in the first place, very much facilitate the escape of the water into the drains; and in consequence of the passage of the water through the stirred up subsoil, and the attendant admission of air, it would be so acted upon as to be converted into good soil, and at the same time have all the advantages of working the active soil as before.

Upon the application of this principle, I have been successful in every instance. The process of applying the subsoil plough is this: a common plough goes along first, and removes a furrow of the active soil. After that the subsoil plough passes along below, and scarifies the subsoil to the depth of from twelve to sixteen inches, in some instances eighteen inches. This is continued furrow after furrow, the plough going first to lay the active soil on the part already opened up; then the plough comes a second time and takes off a furrow from another part of the soil, and places it on that which is already scarified.

As to the proper period for applying the subsoil plough in places where the drains have much effect, the subsoil plough may be applied the following year; but in clay soil it is important to give the clay sufficient time to dry, and to have it in a friable state; because, in the application of the subsoil plough, when clay subsoil has been recently drained, and it is not sufficiently dry, more harm is done than good; the clay being worked in a wet state is almost prepared for making bricks. If we once work it in that state it is a long period before it recovers its friable property again. Therefore, in soils rather free, the subsoil plough may be used the second year after the drainage.

The proper time to execute drains is the summer season; you can then get it much more tidily done, and the drains are prevented from running. In many places there are little sandy veins and portions of running sand, which are very apt to fall in before the drains are covered up. In the winter season this is almost sure to be so; you may be taken with frost, which draws off the adhesion of the earth, so that it falls down, and fills up the drain. It is best to execute them in grass land before it is broken up for cropping, otherwise it is too soft. Executing it therefore in the summer season on the lee produces very little loss, because the growth of the grass in the after part of the season will be so much increased by the execution of the drains, that you will be repaid for the time lost for the use of the pasture during the time the drains were in process of execution. After the drains have been completed, take a crop from the land, and if the land has been pretty good, it will perhaps afford two crops: at all events, one crop should be taken: that will pass over one summer before the subsoil is to be ploughed. During this season, the earth between the two surfaces has time to dry; it is more friable, and the subsoil plough will be more efficacious in stirring it up. It often happens that there are stones in the soil, which must be removed before you can proceed with good husbandry; and it will be found that in consequence of the contraction of the soil, they have become in some degree loose, and will be turned out very easily by the subsoil plough. In many instances we have stones exceeding 200 lbs. weight, which are turned out very easily by the subsoil plough with four horses.

With regard to the direction in which the subsoiling ought to be carried, I should say at right angles with the drains; you thereby form channels from the centre to the side, in all directions. In that manner you form artificial channels from the centre of the ridge into the drain; these may partially close up, still there is an openness given to the subsoil, which will permit the water to pass freely.

Having thus applied the subsoil plough to stir up the subsoil, the after cultivation may be the common rotation of the country, such as the farmer thinks suitable. When agriculturists have subsoiled their land, they should lay down the land flat on the surface, without any ridges or furrows. Nothing is more injurious to land than ridging it up. In the old modes of draining, it was quite necessary to have ridges and furrows; but now, when land is thoroughly drained there is no occasion for it, and it is hurtful; because when water falls on a rounding off surface, it immediately begins to sink away to the lower level, and the water which has fallen on the tops and middle parts of the ridges is added to the water on the side, which has thus to bear a great deal more than its own proportion of water; the water carries portions of the soil along with it, and the cracks are constantly filling up by the running of the sand from the higher part of the ridge to the lower part. When a field is laid down with ridges and furrows, especially on stiff land, a great part of the best of the land runs down into those furrows, and is deposited in large quantities at the bottom of the ridge, thereby doing a material mischief. If laid in a flat form you get rid of this evil, and obtain this advantage—that if the water is beneficial to the soil, which it certainly is, you have that benefit equally distributed; every part receives its own water, and the benefit which the water can give.

It is the suggestion of scientific gentlemen that the rain in falling from the atmosphere absorbs a considerable quantity of ammonia; and if there is any affinity in the soil for ammonia, if the soil wants ammonia, the affinity will extract the ammonia from the water, the ammonia remaining in the soil for the nourishment of plants. Where artificial manure is put into the soil, some of the fibrous parts of it will be carried away with the water, and be carried down to the region to which it belongs; and although not so near the surface as it was before, it is near enough for the plants to reach it: when they put down their roots.

A peculiar change takes place in any subsoil—it does not matter what composed of after it is ploughed. This change begins to take place immediately, and the soil gradually goes from the

state in which it was before to that of a mould. If you examine a soil which has become mould, it is of a peculiar structure. It appears as if all the particles were connected together, and it seems to have some attractive property by gathering together in that way. Vacuities for the air are thus formed, and there is a tendency to absorb and retain as much moisture as is useful to the plant. If filled entirely with moisture it is injurious to the plant, but if a certain quantity, becomes beneficial; and when a great depth of soil is attained, there is great advantage indeed, in either a wet or a dry season. In a wet season the water flows away, leaving the soil in a dry state; but in consequence of the mouldering state in which the soil is, it is retentive of moisture, and there is a great magazine of water preserved in soil for a dry season. Being covered by the active soil, the drought may penetrate a few inches, but in consequence of the lower part of the soil being covered with this upper stratum, it is defended from the extreme action of the rain, and a very dry atmosphere. It will be found that in soil so treated and converted into this mouldy condition, in dry seasons sufficient quantity of moisture will be retained for the use of the plants, which will grow vigorously when land in the same neighborhood is completely dry.

I do not think that it is possible to drain land too much, from the fact that the mould becomes an excellent magazine for the retention of moisture. A circumstance took place in regard to this in my own district, in 1826, a very dry season. In that year there was so long a period of dry weather that the pond was dried up, and there was a great deficiency of crops. I had a field which had been treated in the way I have explained, and I had a crop of hay on it. The hay in the country round produced not above half a crop. On this field, which I had deepened to 16 inches, I had a splendid crop. A proprietor of land in the neighborhood, one of the old school, resisted to the utmost with regard to the result of thorough draining and subsoil ploughing. A person occasionally employed by me was also engaged in doing work for him. He had asked about this hay, and the old gentleman was rather puzzled at the state of the crop, and exclaimed that he really thought I had drained my land so much that I should have no crop at all. He was immediately after this completely wedded to the system, and from that day he has been vigorously engaged in introducing thorough draining and subsoiling all over his estate; and he is now having a great deal of poor soil, on a very rich and productive estate, treated in the same way. Taking the average of that gentleman's estate, he now produces double the quantity of corn that he used to obtain. He now grows potatoes where he could not grow them before, and on the old clay he produces regular and large crops of turnips.

An inquiry was made as to whether there was any land where subsoil ploughing would be successful without thorough draining.

Mr. Smith—I am much obliged for that hint. Many persons have thought that ploughing the subsoil might do without thorough draining, but there are few instances indeed in which that application of the plough will not be hurtful instead of being beneficial. If you have a retentive bottom which will not allow the moisture to pass away, it must remain till absorbed by the atmosphere: therefore the greater the chamber for receiving rain, so much the longer will the land be kept in a wet state. The practice which now prevails in the English clay districts, of ploughing with a shallow harrow, has arisen from the experience of ages, which has taught them that on such soils you cannot cultivate wheat if you plough a deep furrow, because you make just so much the larger chambers to receive water. Even in open soils I would not recommend the application of the subsoil plough till the thorough draining had been executed.

A gentleman asked if it was necessary to repeat the subsoil ploughing?

Mr. Smith—It may not be essentially necessary to repeat the subsoil ploughing, but it is beneficial. I repeat the ploughing at every shift, every time I break up my fallow.

Is it always done in the same line?

Mr. Smith—Generally; sometimes I have done it obliquely.

Did you ever try it diagonally?

Mr. Smith—Yes: perhaps it is better to do it in that way according to the drop of the land. The first idea I had was to use the subsoil plough; then I thought I might use the trench plough, and that I might, the next shift, turn up the whole soil, so as to have a complete mixture. In some fields, where the soil was of a better quality, and there was more vegetable matter, I had excellent crops; on the poorer soils, I found that by bringing up the subsoil to mix with the active soil after the first shift, I did a great deal of mischief. I found, especially with regard to grass, that I could not get that growth of plants which I had before; immediately on observing that I resolved a third time to go over those fields, and that I would again use the subsoil plough; I have now fallen into the practice of doing so every time I turn. I took up at the first shift, perhaps about 3 inches, even in the poorest field, the next time 3 inches more; and by that means I gradually attained a thorough depth of soil to the extent of sixteen inches. On my own farm I have a thorough depth of sixteen inches, but that is in consequence of using a trench plough on the second shift, and in some fields that was unsuccessful. If I had had then the experience I now have, I would use the subsoil plough at each shift; instead of going down the whole sixteen inches, I would only take up perhaps three inches the first time and three the next, till I had completed the depth of sixteen inches.

A gentleman—In draining in the summer season, how do you get the level?

Mr. Smith—By the spirit-level, of course.

A gentleman—The great object would be to get it done cheap; but it would be much more expensive if done in the summer.

Mr. Smith—No doubt; but if I had the choice of executing drains during the winter, at an expense of 50 per cent. less than the summer, I would prefer doing it in summer. The efficiency is of far more importance than the expense.

In summer sometimes the land may be too hard?

Yes. In some places, but the bulk of the land will retain as much moisture as will enable you to get through it with the plough. Of course that

will vary in different parts of the country. In some places it had better be done when the ground is more moist. Still, I would recommend it to be done, not in the winter, but in the spring or autumn.

A gentleman—I may be perhaps allowed to say that there are cases where subsoil ploughing is effective without thorough draining—as, for instance, in the soils of the moorlands. I have tried it myself in the moorlands, and have found that by simply breaking up that pan which holds up the water which made the lands dry in summer and wet in winter, all the water escaped; and lands before not worth 5s. an acre, let for 20s. after it was done. That was certainly a peculiar case.

A gentleman inquired whether the rocks under the stratification were horizontal or perpendicular.

Mr. Smith—There was very little stratification at all. I am aware of what has been stated with regard to destroying the pans, such as are placed upon gravel, but, thorough draining may be applied with advantage to sand or to gravel; and though in the gravel the opening must be at a considerable distance, and consequently the water will be long in finding its way out, if it gets into the channel it will go off easily. These dry soils retain moisture a great deal too long for agricultural purposes. A neighbor of mine was draining his land—a sort of irregular subsoil—and in some places had very considerable ruts or rising ground with sandy and gravel bottom; he instructed his steward to stop the drain when he came to those holes. This was done, and two winters after the gentleman was coursing one day, and all at once his horse sunk over the fetlocks in the soft ground. He called out to his steward to know the cause, and his steward explained that this was the portion of land on which he had desired the drain to be stopped. This fact illustrates what I have said, that when agriculturists have determined on draining a field they should resolve to drain it wholly, otherwise they are only throwing the expense away. Where persons have drained wet parts, and left what they considered dry undrained, they have soon found that the land formerly the wettest was then driest, and when the part which had been drained was ready to receive the seed, they were delayed a few days till the other portion was sufficiently dry. In a country where we have much changeable weather, all agriculturists know the advantage of a single day. If a field is uniformly drained all over, you will perhaps be able to sow your seed one, two, or three or four days earlier than if it were not drained; sometimes now you lose the opportunity altogether, because it frequently happens that two or three days intervene; very newly dried land will be ready for being sown, whereas other land which was not drained, would require a week or fortnight before you could sow it.

With regard to the application of thorough draining on porous bottoms, no doubt much good will be effected without subsoil ploughing. I have found it most efficacious on sandy and gravel bottom. I have known instances of land of that nature being very greatly improved after being stirred up by the application of the subsoil plough.

A gentleman—Your observations apply to thorough draining; many people call it *furrow* draining. I wish to know whether you have any reference to deep draining, and how, as in the case of a spring lying deep, you meet the difficulty occasioned by the water. Two feet and a half drains would not touch a spring such as that described on the diagram. How do you get away the spring water.

Mr. Smith—They are called furrow drains, because they are made in the furrows. I call the mode of doing it *thorough* draining. I use the term to express the result. They are called sometimes wedge drains, top drains and tile drains; but the principle is, that you have the drains sufficiently close together to carry off the water quickly; and then, that the best mode of laying them off for that purpose is to arrange them in parallel lines, and carry them as much as possible in the sloping direction of the land.

With regard to springs, the spring water can do no harm till it enters the subsoil; so long as it keeps below that, you need not care about it. The moment it reaches the bottom of the drain, it finds its way into it, and will be carried off by it. I have found it necessary sometimes to carry a drain through the eye of the spring. Springs sometimes come in little channels, at other times in a sheet, according to the nature of the subsoil. When they come in a sheet, the cross cutting completely scarifies them. If a spring comes out at a round opening and happens to fall in between two drains, I have found it necessary to cut the drain into the eye of the spring. But in every instance where the water flows between two beds, I have found that by cutting the drain across, it was completely cut off.

I will now describe to you the mode of constructing the draining tile of Lord James Hay. One way of doing it is to construct the tile on the ground, and then carefully place it in the drain; the other is to execute it in the drain as you go along, and immediately to cover it up. The composition of the tile may be varied considerably, but the proportions which I have found to do very well are—

Lime - - - - -	1 part
Blackened cinders - -	0½ part
Sharp fine sand - - -	3 parts
Gravel - - - - -	3 parts

making altogether 7½ parts, or 1 measure of lime to 6½ of sand and gravel; the cinders may either be used or not. The gravel selected should not be of a large size.

A question has been handed to me as follows: "What effect have thorough draining and subsoil ploughing on the habit of throwing out the wheat plant by frost?" It is well known to be owing to the moisture that the wheat plant is thrown out, and whatever removes the moisture, will have the favorable tendency required. I have known many places where almost every winter the greater part of the plants were thrown out. Now, the result of thorough draining and subsoil ploughing is that they retain the plant perfectly well, and have very abundant crops.

The best of the two modes which I mentioned of forming the tiles, is to make them just where the drain is wanted, and in a few days they will become so dry that they can be placed in the drain. One disadvantage is, that these tiles will not stand carting for a length of time. They require several months before they will admit o

being laid on over one another. But in most instances, the making of the tiles can be accomplished on the spot, and in the course of a few days they may be put into the drain. It is, then, of great importance to cover them immediately with some light soil, free from stones, and to beat them down so as to preserve it from injury. If there are any stones in the soil, they may get down to the tile and seriously injure it.

[The lecturer then exhibited the method of forming the tiles in the drains, which is done by placing the mould in the place in the drain to be occupied by the tile, then laying upon it the concrete, and after pressure by an instrument similar to that used in the former process, drawing out the mould by means of a long handle attached to it for that purpose.]

I have an interesting communication to day from Scotland, which, though not immediately connected with the subject before us, bears intimately upon it. There are great doubts respecting the propriety of putting seed deep into the soil, or covering it very lightly. Experiments have been made on that subject, but none so conclusively as that which I have now before me, which relates to the springing up of the more tender seeds, the grass seeds; and it shows the great importance of having a shallow covering over them. This experiment was made by the Messrs. Drummond of Stirling, the individuals who first introduced the agricultural museums.

This experiment tends to show the great importance of a light covering to grass seeds. I have made a harrow of a peculiar construction, which reduces the surface soil very much without tearing up the ground. It has no teeth, but acts by little sharp discs closely set together, which curve very slightly. I have found this instrument also very efficacious if used as a bush harrow.

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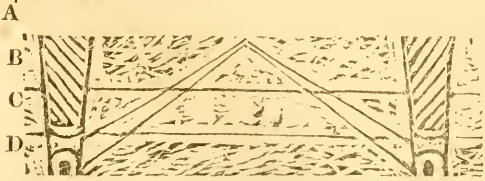
CONTINUATION OF MR. SMITH'S LECTURE.

The report of Mr. Smith's Lecture was given from the Mark Lane Express, which did not contain the diagrams to which Mr. Smith is reported to have referred when lecturing. After that report was in type we received a second copy of the Lecture in the London Farmer's Magazine, with the diagrams. For the gratification of our readers we subjoin these diagrams with the accompanying explanation. Though not in their original position, they will not be found out of place; and the mere report of this lecture to any intelligent farmer is worth ten times the annual subscription of our paper.—ED. N. G. F.

I shall first endeavor to illustrate by a diagram, the mode in which this system of drainage operates.

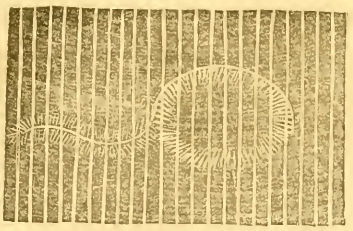


A represents the atmosphere, B the active soil, and C the subsoil stirred by the plough; D represents the part of the subsoil above the level of the drain.—When the ground has been so drained, the first effect that takes place is the drying of the subsoil, which begins generally at the drain, however close and dense it may have been; it begins to crack there by the water giving way. These cracks are continued till they pervade more or less; and in the course of a few months, or perhaps a couple of years, they may have obtained complete effect; the whole of the soil has become dry. The soil which has been worked before on the surface of the subsoil, is in an open state from its former working; the rain falls on the earth, and is received into the intervening spaces, the chambers all receiving so much rain, and the different parts of the soil absorbing a quantity of rain. But while the rain is falling, the drains are carrying off the water from the whole mass. Of course when the rain ceases to fall, this water goes off more rapidly.—At first it will be brim full (if I may use the expression) of water; it is constantly running off, and the water gradually subsides.

The usual practice is to make the drain two feet deep, but I prefer two feet six inches, for this reason, that it is of the greatest importance that the whole should flow off as rapidly as possible. Persons are apt to suppose that the water will not find its way to a drain at a great depth, but that is in some measure a great mistake. When there is more water to pass through, there is more retardation to the passing of the soil; but, notwithstanding, by giving the drain the inclination which I propose, you have the water carried off much faster. There is also this advantage—that when there has been a long season of dry weather, the whole of the bench becomes completely dry; and in that case it takes much rain to wet it, and if the rain is not very abundant, perhaps the water will not stand higher than B. When water falls upon the soil, there is one very great advantage in having a large bench besides. There is a quantity of air which fills all the vacuities in the soils—the active soil itself, the stirred subsoil, and the subsoil which has been laid dry. When the water has drained off, air takes its place, and the action of the air is very beneficial on the whole of the soil moved, particularly the active soil; and just in proportion as you have a great area to receive the water, and to receive air as the water is drawn off, so in proportion you have a tide of atmospheric air passing through the belt of active soil which is found very much to improve it. We know this soil is very much improved by exposure to the atmosphere; but if it improves in a greater degree by exposure to the sun and light, it is still importantly improved by the passage of the air to the lower strata when the water is withdrawn.

In order to render a field completely dry, it is necessary that a great number of drains should be placed in it; and the position in which they should be arranged will be obvious from this diagram, which represents a field sloping down, with a rising ground in the centre, and rising ground towards the side.

This is made for the purpose of illustrating the mode of laying off drains, and the mode of catching the water when any hollows intervene. In laying off the drains, you will drain the field more effectually by laying them off in parallel lines, than by doing it in any other form; because, if you depart from the parallel lines, you get into corners, and into some spaces not so near the drain, and others too far from it. But in laying it off in the manner



shown in the diagram, you get a complete effect on the whole surface. When drains are laid off to run in the direction down the slope, they have a much greater effect in draining than when laid across the field. It is rather difficult to induce persons to believe this, but it is the fact. If carried across the field, though they may catch the water, yet, having less declination, it will remain longer at the bottom of the drains. Another objection is, that the water which is there retained has a tendency to sink away to the sides of the drain, and therefore will probably come up some distance below the drain. But if the drains are carried in the direction pointed out, you cut the drain so that the water constantly sinks into it; and though it may fall a little into the slope of the hill, yet the greater part of it goes to the drain.

CHANGE OF SEED.

By Professor Sprengel, of Göttingen.

Translated for the New Genesee Farmer from the German.

Occasional change of seed is unquestionably of the highest importance in agriculture. Observant farmers have doubtless remarked that, though all possible pains be taken to secure the best and most perfect seed grain, it is generally more advantageous to procure a supply from some other and distant section of country.

In the year 1811, I obtained a parcel of multicaulis rye from Friedland in Bohemia—a celebrated rye district, having a clay soil. This rye, thus brought a distance of 21 miles, was sown in a sandy soil, rich in humus, which had been manured by ploughing in a green crop of vetches. It vegetated well, grew astonishingly, and attained a height of from 9 to 9½ feet, with heads proportionably long—measuring from 9 to 10 inches, and containing from 115 to 120 grains each. In the ensuing fall I sowed some of the rye thus produced, on a soil of similar character and equal quality, manured as before by turning in a crop of vetches. The stalks, however, scarcely attained a height of 7 feet—which was the more remarkable, as, in the summer of 1812, the season being peculiarly propitious, all the other rye in the vicinity was unusually tall. When sown again, the following season, this rye produced stalks averaging only 5 feet high; and the heads were proportionably shorter and less productive, in each year. The deterioration of this rye was rendered the more obvious, as, in the year 1812, I procured some fresh seed from the original locality; seeded it on land of similar quality, after ploughing in vetches as before, the stalks of which grew to the height of from 8 to 8½ feet—contrasting strongly with the more stunted growth of the other.

I have experienced similar results in the cultivation of buckwheat, oats, barley, beans, potatoes, and flax. With us, the stalks of Indian corn, also, from seed imported from the southern part of the United States, attain a height of 15 or 16 feet, the first year; but the product of the second seeding will not exceed 10 feet in height: and in the third year, it will not be taller than our domestic corn.

On many soils a frequent change of seed appears to be essential, for various reasons. It is undoubtedly true that the seed can only produce a vigorous and perfect plant, when its germ is adequately developed; and it is equally certain that such a developement can result only from a proper commixture of the ingredients of a soil, aided by the influence of climate, seasons, &c. But the success of the plant is determined also, in a great measure, by the kind of nourishment afforded to its earliest germs and radicles. Hence, when seed grain, having a perfect germ, is supplied, seasonably and in due proportions, with those substances which contain, in an assimilable state, the peculiar *pabulum* or nourishment which the infant plant needs, it will grow vigorously, and flourish permanently to maturity if the soil continue subsequently to furnish a proper supply of the requisite food. A field recently manured with fresh stable dung, it is well known, will not produce good seed grain; and hence it is probable that the good or bad quality of seed grain depends on the presence or absence of certain ingredients of soils. Grain grown on land recently manured with animal dung, contains, according to Hermbstadt, more *gluten* than that grown on lands not so manured; and where the land was manured with sheep dung, the grain produced is peculiarly rich in gluten, because this kind of manure contains in abundance the nitrogen essential to its formation. Now such grain is probably unsuited for seed, precisely because it contains too great a quantity or proportion of gluten, whereby the starch of the seed grain is too suddenly decomposed. Whereas, were a less proportion of gluten present, the starch would be *gradually* converted into *sugar*—the earliest food required by the developing germ. We may therefore conclude that, in general, all grain is unsuited for seed if it contain a very large proportion of gluten, or of other nitrogenous substances capable of converting starch rapidly or suddenly into sugar. But in grain intended for breadstuffs, this over-proportion of gluten is a very desirable quality; because the more of it any grain contains, the better is it adapted for producing flour—gluten being among the most nourishing substances.

Experienced farmers know it to be very advantageous to sow, in a sandy soil, rye grown on clayey or aluminous upland. The reason appears to be this, that the rye from clay soils contains only the due proportion of gluten. On the contrary, it is found to be improper to sow rye from rich, moist bottom lands on sandy soils; because the seed contains such an over-proportion of gluten as to convert the whole of the starch suddenly into sugar, and the sugar as suddenly into other substances not congenial to the germinating plant. Sandy soils in general do not furnish good seed grain, inasmuch as such grain is deficient in certain substances—as lime, magnesia, &c.—essential, nay indispensable, to the perfect develope-

ment of the germ. That sugar does, in fact, play an important part in the germination of seeds and the first developement of the plumule and radicle, is manifest from the fact that all the minutia seeds, parsley, carrots, &c., germinate better if steeped for a few days in a solution of sugar or in a diluted syrup. But though sugar is unquestionably of great importance in the germination of seeds and in the earlier developement of plants, I do not maintain nor assert that the successful issue of the process is the effect, exclusively, of this substance. On the contrary, I am convinced that, to secure a propitious result, the presence also of alkalies, sulphates, and chlorides, in due quantities and proportions, is absolutely requisite.

There are soils which imperiously require an annual change of seed. But it is, in most cases, sufficient to procure a supply from places in the immediate vicinity, or not more than three or four miles distant—a circumstance which the principles above indicated will serve to explain.

Climate also has a very conspicuous and important influence on the quality of seed grain; and experience teaches that, for seed, such grain is best suited as was grown in a colder region or district. Chemical analysis shows that such grain contains a smaller quantity of gluten than that grown in warmer climates. Wheat from the north of Europe contains much less gluten than that from the southern coasts of the Mediterranean.

The deterioration of grain, so as to become unfit for continued seeding, I have most frequently observed in oats. But I remarked, in every instance, that the soils which produced bad seed oats were deficient in lime, magnesia, or some other substance or ingredient requisite to the full developement of the germ. Oats invariably become unfit for seed if sown in soils deficient in lime or potash; and chemical examination shows that good seed oats contain much lime and potash. Now, though we may, from these and similar circumstances, deduce in part the reasons why a change of seed is oftimes necessary, it is not to be denied that, for the full elucidation of this matter, more numerous experiments and observations are desirable. Probably results highly satisfactory could be arrived at, if good and bad seed grain, as well as the soils on which they respectively grew, were subjected to accurate chemical analysis.

The great benefit resulting from frequent changes of seed is particularly striking in the culture of flax; it being well ascertained that seed imported from Russia is greatly superior to that of domestic growth. Russian flax-seed, though commonly an ill-looking, unpromising article, invariably produces a much longer stalk and fibre than native seed, apparently much better. That climate likewise, in this case, exerts an important influence on the due proportionment and admixture of the ingredients of the seed, may be considered certain. But what the ingredients really are which contribute to, or effectuate, the more vigorous growth of the flax from Russian seed, remains to be ascertained.

Again, by means of seed grain, climate may in some sense, and to some extent, be transferred from one region to another. Thus, if we sow, in a colder climate, seed oats from a warmer district, where oats ripen early, the plant will, in its new locality, mature at an earlier period than the domestic oat, though not so early as in its native region.

Finally, it may be considered as an ascertained fact, that soils chemically ill constituted, require the most perfect and best seed grain. A judicious selection will, in such cases, very materially increase the quantity of the product—the difference being in some cases not less than fifty per cent.

ANCIENT AND MODERN AQUEDUCTS.

From the New York State Mechanic.

The firemen of the city of New York have chosen the 10th of September, the anniversary of Perry's victory on Lake Erie, to celebrate the achievement of the Croton aqueduct, the most perfect and efficient structure of the kind of ancient or modern times. Although contrivances for the conveyance of water from distant sources, for the supply of cities, are of great antiquity, we have no accounts of aqueducts, properly so called, till the time of the Romans. The city of Samos, says Herodotus, was supplied with water by piercing a hill 300 feet in height, by a tunnel 4,200 feet long, 8 feet high and 8 feet broad. In Egypt, in Babylon, and in Judea, works of considerable extent were constructed for the conveyance of water. The Romans were celebrated for their aqueducts, which were not confined to the capital, but were constructed at many of their most important cities in Europe, Asia, and Africa, the remains of which are still seen. That of Segovia, in Spain, built in the time of Trajan, is a magnificant work, consisting of double rows of arches, 109 in number, according to Malte Brun, the largest of which are nearly 90 feet in height from the ground to the conduit, and wholly consisting of enormous stones joined together without mortar, by which water has been conveyed into the town for seventeen hundred years. The neighborhood of Rome is distinguished by a long series of these almost unperishing memorials of her ancient magnificence. Some of them are still in use, and others, though in a state of ruin, are among the greatest ornaments of Italy. Some idea may be had of the extent and importance of these works, from the fact that the city, containing a population of four millions, was supplied with water from sources varying from thirty to sixty miles in distance, and that at one period no less than twenty aqueducts brought as many streams across the wide plain in which the city stands. Artificial channels winding along the hills and mountains, and tunnels through interposing barriers, led the water the greater portion of the distance: but the aqueduct was required to cross the valleys, and to conduct the stream from the surrounding hills to the walls of the eternal city. In some places their manner of construction required arches of 200 feet in height, and one aqueduct is said to have consisted of nearly 7,000 arches, in many places more than one hundred feet high. There is nothing more interesting, or more really beautiful, says a writer on this subject, in the existing ruins of ancient Rome, than the remains of these splendid works, which radiate in almost every direction, and run across the almost level plain, out of which its hills arise in long arcaded series, whose simplicity and long unbroken continuity produces a degree of

grandeur unmatched by the more labored and more pretending works within the walls. The city is still abundantly supplied with water by three of these ancient aqueducts, which have undergone repairs and restorations by the direction of the Popes. The *Aqua Virginia* and *Aqua Felice* are the principal.

Of the most celebrated aqueducts of modern times are that of Caserta in Naples, and of Maintenon in France, begun by Louis XIV. in 1684, to carry water from the river Eure to Versailles, but abandoned in 1688. This was designed to have been the most stupendous aqueduct in the world; the whole length contemplated was 60,000 fathoms; the bridge 2,070 fathoms, consisting of 632 arches 220 feet high. There is also a modern aqueduct at Bemfica, near Lisbon, in Portugal.

The Croton aqueduct greatly surpasses any of the above structures, both in magnitude and perfection. There is no useless display of gigantic arches and enormous stones, but the whole is a beautiful monument of the perfection to which the art has arrived at this day—simple, efficient, and durable. It may not present so imposing a front to the vulgar, but to the engineer and the man of science, it has an air of grandeur and sublimity arising from the vastness of its proportions. The main trunk is 40 miles in length, wholly composed of masonry, 6 1-2 feet wide, and 9 feet high. The walls are 3 feet thick, cemented into solid rock. The grand reservoir at the head of the aqueduct is caused by a dam of stone work 40 feet high and 70 broad, thrown across the Croton river, forming an expanse of water 500 acres in extent, sufficient to supply any emergency. The trunk is carried over valleys and streams, through hills and barriers of solid rock, affording opportunities to the engineer for the display of skill and taste, which has been improved with very happy effect. For instance, the bridge which crosses the Sing Sing creek is a single elliptical arch of 80 feet span, and 100 feet above the stream. The bridge across Harlem river is 1300 feet in length, 116 feet above high water, and cost nearly $800,000. Sleepy Hollow is also spanned by a series of graceful arches, and the valley of Glendenning is passed at an elevation of 40 feet, affording carriage-ways and footpaths over its arches. At Manhattanville the work is carried through the hill by a tunnel, and under the valley by pipes descending 105 feet. This mode of crossing the valleys, it is believed, the Romans never attempted, but carried the stream at a pitch of from one inch to half a foot to the hundred feet, and where the force of the current was too great, it was overcome by curves.

The water, thus conducted 38 miles, is received into the reservoir at Yorkville, which contains an area of 35 acres, enclosed by granite walls, and capable of receiving 160 millions of gallons. The distributing reservoir at Murray's Hill is also a work of great magnitude and expense, and calculated to endure as long as the hills and rocks. It is in the Egyptian style of architecture, with a promenade 20 feet in width at the top of the walls, flagged, and provided with an iron railing. It employed 400 men four years in its construction. Altogether, it is a triumph of skill and enterprise, of which the world presents few equals. Its completion will require two or three years yet, although temporary pipes are laid, by which water was distributed to the city on the 4th of July last. Its advantages to the city in the extinguishment of fires alone are incalculable. In the great conflagration of 1835 the amount of property destroyed was estimated at seventeen millions of dollars, one third more than the cost of this work; the extent of which was in a great degree attributable to the want of a convenient supply of water. The fire department, appreciating the great importance of the work on this score, have set apart a glorious day in our country's annals for an appropriate celebration. We hope no storm cloud may be so overcome as to shed its tears upon the scene.

ON THE IMPROPER USE OF THE PLOUGH IN THE CULTIVATION OF INDIAN CORN.

From the Southern Agriculturist.

Mr. Editor—By request, I submit to you, for insertion in the Agriculturist, some remarks and experiments I have made to prove that the plough is frequently used too late, and much to the injury of our corn crops.

It is well known to rice planters, that when rice is in joint and forming its ear, every effort must be made to advance its growth, so that good ears may be formed. The same effort, to effect the same result, is necessary with corn, and all other grains. When the ear is about to be formed, the atmosphere has less influence on the plant than previously; therefore more is required from the roots. If the soil is fertile, and well broken up with the plough previous to planting corn, innumerable small fibrous roots will run laterally, in search of nutriment, to the distance of six or eight feet, and sometimes as far as twenty feet. These laterals are very small, and easily separated from the stalk; if cut by the plough when the plant is young, no injury will be sustained, and perhaps a benefit: but they must not be cut or disturbed in any way when far advanced toward maturity. Without their aid at that period, the perpendicular, or tap-root, will not be sufficient to produce good and well filled ears. It is not unfrequently the case, that the plough is used when the corn is in silk, and at that time these lateral roots are very numerous about the surface of the ground, and must necessarily be cut, much to the injury of the crop. I have made several experiments which prove conclusively that the perpendicular or tap-roots are not sufficient without the aid of the lateral roots to produce good and well-filled ears; and that, if the plough is used too late, a good crop cannot be expected. For my experiment I selected eight well-grown stalks, just before shooting out their tassels. I had the earth cut round two of these stalks about six or eight inches from them to the depth and width of the spade, and the earth removed, so that I could see that all the side roots were cut. The earth was permitted to remain in this situation until the corn was matured. The stalks looked well, and the ears appeared to be well filled; but, on examination, it was found that there were but a few scattered grains in them.

In the next experiment a cut was made around two stalks, with a spade to its depth and width, at the same distance as above. This cut was permitted to close immediately, no earth having been removed. The result was, small ears, not well filled.

The third experiment was to cut the roots on two sides of the stalk, as they are usually cut in late ploughing. On the other sides the roots were not disturbed. The result—small ears, tolerably well filled.

In the remaining two stalks, no roots were cut or disturbed; the ears large and well filled.

The plough is not sufficiently used on our rice plantations, in preparing corn land for planting, and is generally used too late after planting, If the soil has been well prepared and in good tilth, the cultivator or hoe harrow may be used most advantageously after the second ploughing. As soon as the plants can be ploughed, the first furrow ought to be thrown from it, and the second to it; and if used again, the sooner the better, so that the corn may be laid by, when it has attained a third of its growth, or very soon after.

I will here remark, that the planter who wishes to increase his corn crop in quantity, must select his seed in the field. Seed from those stalks that have produced from three to six ears, will, in like manner, produce again from three to six ears, if the soil is well manured and well cultivated; and seed from those stalks that have produced one ear will again, in all probability, produce but one ear.

JOHN H. TUCKER.

Hampstead, Sept. 9th, 1842.

LICE ON CHICKENS.

From the American Farmer.

Mr. Editor—Having discovered an effectual mode of destroying lice in hen houses, and on chickens, and thinking it may prove useful to some of the readers of your valuable paper, I give it as follows.

To destroy lice in hen-houses.—Clear the hen house out thoroughly; then wash the walls, floor, roosts, and particularly the nests, with tobacco juice or tobacco water, from the tobacconist's; then put some fresh hay or straw in the nests, and sprinkle them with the juice, and as soon as the house is dry, you may let your chickens into it. If you find that this does not destroy them effectually, repeat the operation.

To kill the lice on about fifty chickens, take a pint of the strongest grease you can get conveniently, and mix with it about an eighth of a pound of Scotch snuff, and grease them under the wings and on the back of the neck.

Baltimore county. JUVENIS.

THE POLAR PLANT OF THE WESTERN PRAIRIES—A VEGETABLE COMPASS.

From the National Intelligencer.

Washington, August 9, 1842.

Dear sir:—In offering through you to the National Institution a dry-pressed specimen of the *polar plant of the western prairies*, it is proper that I should give a description of it and of its location. It is a species of fern, with one large flat leaf, *whose plane always points to the north and south.* The leaf is symmetrically disposed about the stalk. It attains the height of from ten to sixteen inches, and it is believed that it never blossoms. It is spread profusely in large beds over all the western prairies, from the far north-west to the far south-west. It has been seen in the prairies of Wisconsin and other regions east of the Mississippi. It is never found in the forests; or in other words, out of the prairies. It has been well known to the hunters and trappers of the west, and to the officers of dragoons; but I believe that its existence has never (at least extensively) been made known to the world. Its plane is always in the plane of the meridian, when not disturbed by high winds or other external causes. The indications are always most accurate in the valleys, where the beds are sheltered from the winds, and where the traveller finds them arranged in parallel positions, faithfully pointing out the direction of the meridian. The leaf is symmetrical, and thus there is nothing in its indications to distinguish the north from the south.

The specimen which I send was plucked from the prairies near Fort Gibson, west of Arkansas.

That its indications are actually the same wherever found is the universal testimony of all who have known of it; and I have met many who have noticed it from south of Fort Towson to a considerable distance north of Fort Leavenworth. In many instances those who spoke of it derived their first intimation of its existence from that excellent officer and capital woodsman, Capt. Nathan Boone, of 1st regiment U. S. Dragoons, son of the celebrated Daniel Boone.

The cause of the polarity of this curious plant yet remains to be discovered. Being symmetrical in shape, or rather the weight being equally distributed about the stem, it is possible that its sap or fibre is so thoroughly impregnated with certain salts of iron as to be deviated, from the period of its infant growth, by the action of the magnetism of the earth, turning like a compass needle on its stem or root as a pivot. That it is not caused by the action of light would seem probable from analogy, as vegetables acted upon by light are noted for turning their leaves or blossoms towards the sun instead of from it. At midday the plane of the polar plant passes through the sun, and thus it shuns the light. I have noticed it in long-continued cloudy weather, and could find no alteration in its position.

As the existence of the torpedo and the electrical eel exhibited the influence of electricity on animal life, this plant is very interesting as showing its probable connexion also with vegetable life; thus furnishing a link to supply the chain of gradation. It is well known that there are many distinguished naturalists and professors of physiology who would go higher still, even to the human frame, and predict the final discovery of the intimate connexion between electricity and the operation of the nervous system. Any fact connected with the action of electricity or magnetism (supposed to be one and the same agent) is now especially interesting, when there are so many ingenious minds throughout the world devoted to such investigations.

I have ascertained to my satisfaction that this plant has been well known to trappers and to many of the Indian tribes, and that they have been in the habit of availing themselves (in their tours over those vast tracts) of this humble but omnipresent guide, which a kind Providence has sprinkled over that region, and which is thus available in

cloudy weather, when the sun and stars are denied them. Even if it is granted that it is less needed by the red man, no one will deny its uses to the whites in a country destined still for a long period to be roamed by hunters, traders, pioneers, and other white men.

I will here add that Captain Boon also states that there is spread all over the far west a certain root, called the "snake root," whose juices are very grateful to quench thirst, and which is found in the greatest abundance in those parts of the prairies which are high or dry, and most likely to be deprived of water in a season of heat and long drought.

It is needless to descant upon these beautiful and striking examples of the wise provision of Nature, furnishing a vegetable compass and the means of quenching thirst, ever ready for the wanderer, and both located in a region destined perhaps for the longest period in the history of the world to be occupied by a roving population. I am, with high respect, your obedient servant,

BENJ. ALVORD.
Lieutenant United States' Army.

To F. MARKOE, jr., esq.
Cor. Sec. of the National Institution.

MANURE.

From the New Genesee Farmer.

The first step which a farmer takes toward successful business, is to understand the value of manure. And as he discovers the value, he uses all the means in his power to increase the quantity. The fact is, if every farmer who owns a hundred acres of good land, and who manages his manure according to the usual practice of the country, were to use the very best means which he possesses for its manufacture and application, he would find his pocket-book heavier at the end of each year, to use the most moderate computation at the present low prices, by at least three hundred dollars.

I need not here attempt to show how that the product of the barn-yard may be increased fourfold by the use of muck or marsh mud and lime properly applied; but my object is to call attention to another source of manure which appears to be even less known and attended to. But I ought here at the outset to caution the delicate and fastidious reader not to follow me any further, as the editor did some time ago at the *close* of a similar article, though of course I mention this fact with all deference.

Poudrette is well known to be a very powerful manure, obtained in the neighborhoods of the cities where it is manufactured. But we, away back here in the country, do not possess this advantage which our city friends do; and very few have ever thought of manufacturing their own poudrette. The contents of privies, instead of being regarded as of great value as they truly are, most people look upon as a downright nuisance. Now, if the offensive odor may be removed, at the same time that a valuable manure is made, two very important points will be attained.

I have searched in vain for a particular account of the process employed by the poudrette companies; and in the absence of such account have endeavored to use such means and knowledge as I could lay hold of; and imperfect as the mode may be, it has been of decided value to me, and may prove so to others. The entrance to the privy is well flanked with evergreen trees, and on one of the other sides which faces low ground, is a passage or road through the trees for a large tight box or trough to be drawn away from under the building, which is placed about two feet above the ground on that side for the admission of the box. A plank door shuts it in closely. Runners are placed under it so that a horse may draw it away by the iron hooks attached to it; low wheels would be better.

All the care required after this, is to sprinkle every two or three days a few handfuls of plaster (gypsum) over the inside of the box from above. This is all. Air-slacked lime and ashes are also valuable; but plaster, by furnishing sulphuric acid for combination with the gaseous ammonia, and thus preventing the escape of this volatile, but powerful ingredient, is considered the most so. Hence also, the use of plaster is found exceedingly to lessen the fœtid odor, a matter of no small consequence. Lime also greatly lessens the offensive smell, but by what means I do not know. There ought to be enough of plaster, lime or ashes, to keep the contents of the box in a dry state. When it is full, it is drawn off, spread upon the ground and mixed with the soil, or made to constitute a part of the compost heap.

I have tried only one experiment on its fertilizing power, and that a very indefinite, but otherwise satisfactory one. Very rich stable manure and poudrette were applied to different parts of a small piece of ground—the stable manure, according to estimate, being about ten times the bulk of the night soil or unmixed base. The whole was sown with turnips. The result is so far, that the turnips on the part manured with the poudrette have made a growth at least three times as great as those on the part treated with stable manure. J.

PRESERVATION OF PEACH TREES.

From the Farmers' Cabinet.

Whitemarsh, Sept. 1st, 1842.

Having, to a certain extent, succeeded in the cultivation of the peach in a limestone soil, generally considered uncongenial to its growth, I forward by your request, a short account of the method of cultivation and mode of nursing adopted.

The soil of the peach orchard is underlaid with primitive limestone, but is not of the yellow cast and tenacious texture, so general in limestone regions; which, however adapted to the growth of wheat, has but little affinity with any description of fruit. It is, on the contrary, a rich loam, and constitutes a part of the garden enclosure, the trees occupying about half an acre, and bordering on the Wissahickon creek. This location, in the immediate vicinity of the water, may possibly have a beneficial effect.

The orchard, consisting of about fifty trees, was planted in the spring of 1836. At the time of planting the ground was in grass, but was then subjected to the action of the plough, and has

since been thoroughly tilled every year, yielding alternately heavy crops of sugar beets, potatoes and ruta baga. The trees have also been examined once, and sometimes twice a year, for worms, but have not generally been much infested by them.

This comparative exemption is no doubt in consequence of the various alkaline substances which have been successfully used. The most remarkable and immediate effect has followed the use of what is termed "fallen lime," fresh from the kiln; which, when applied in the proportion of about half a peck to the roots of unhealthy trees, and covered with earth, has restored a healthy color to the leaves: and trees which did not look worth a week's purchase, have produced fair crops of good fruit in after years. Ashes from anthracite coal, have also been applied with very good effect. These applications have usually been made in the spring, but occasionally later in the season. This year, wood ashes were used in June, with a marked benefit. Soap suds also have been applied to advantage. In fact, any substance, which by its caustic quality is destructive of insect life, must be beneficial, provided it be not applied in quantities sufficient to injure vegetation. It is an interesting and encouraging circumstance, that several substances combine the properties of destructiveness to insect life, with a direct and positive stimulating effect upon vegetation. In illustration of this fact, my friend Dr. Noble has applied oil soap to a portion of his extensive peach orchard, in the state of Delaware, to manifest advantage.

The mild weather of January and February will sometimes bring forward vegetation, so that the peach trees are liable to blossom prematurely. An attempt has been made to obviate this difficulty, by covering the roots about the body of the trees with wheat straw, when the ground is deeply frozen in winter. This process, by retarding vegetation, has secured them from the danger of the late frosts.

When, however, an intensely severe frost occurs late in winter, so as to freeze the germ of the fruit, which is developed very early, all expectation of a crop must be abandoned. This misfortune is easily verified, by an examination of the germ, when the embryo peach will be found black and blasted.

These observations are not set forth under the impression that they are new, for doubtless they are familiar to those enterprising farmers, who, by their successful cultivation, supply our city markets with this most healthy and delicious fruit;—such a universal favorite, that it would be an era in a lifetime, to find a man who did not like a peach. It is to be hoped that larger and more successful producers, may be induced to favor you with a detail of their mode of operations to the advantage of the agricultural community and the public at large, whose interests indeed are identical.

The writer had the pleasure of examining the extensive peach orchard of Major Reybold, near Delaware City, in the month of May; at which time that enterprising farmer had a prospect, as he stated, of about half a crop. It covered 120 acres of land, and contained 12,960 trees. His half a crop has produced 6,000 baskets, which have been chiefly sent to the New York market. A remarkable fact in connexion with the produce of this and the neighboring orchards, was mentioned by him and confirmed by several other gentlemen of that vicinity. A cold north-west breeze had prevailed during an afternoon while the trees were in bloom, which was accompanied in the evening by so severe a frost, that the total failure of the peach crop was anticipated. About 11½ o'clock at night the wind changed to south-east, which blowing over Delaware bay, so far modified by its mildness and moisture the air of that portion of the orchard which was nearest the water, and descended towards it, that the blossom was saved. The other portion of the same orchard, which inclined inland, and had received the full force of the cold blast, was almost a total failure.

From the healthy appearance and vigorous growth of many of my trees, I have a hope of securing a degree of longevity for them so desirable, considering the care and expense inevitable in their cultivation. Several of them are now about six inches in diameter, a foot from the ground, and the produce this year is estimated at from 30 to 40 bushels.

That peach trees are capable of attaining to considerable longevity, can be attested by many of your readers, who may remember them struggling for years in the hedge-rows of bushes, which were wont to adorn the fences of old fashioned farmers. There is now a tree in the garden of a lady in Arch street, Philadelphia, planted 25 years ago, which this season produced a good crop of fruit. William Cobbett, also, in his valuable little treatise, "The American Gardener," page 199, refers to a peach tree in France, in full bearing, as 50 years old.

MORRIS LONGSTRETH.

Valley Green.

USE OF CAMELS ON THE WESTERN PRAIRIES.

From the New Genesee Farmer.

Mr. Editor.—The writer of this is a native of Russia, and has spent many years of his life in that portion of the empire which borders on the Ural and Volga rivers, north of the Caspian sea.

I have, during the last two years, visited many parts of the United States; lately I have been in Missouri, Iowa and Wisconsin, and during my journeyings have had the fact strongly impressed on my mind, that the *camel* would prove a most valuable animal for burden in those prairies, and especially for traversing the country west even of the states I mention, where water is sometimes not found for days.

Camels used only for travelling possess great speed, and in the unsettled country would be found good to carry mails and convey intelligence. Their speed is great, 120 miles being a common day's travel for speedy animals.

Some individuals have expressed to me doubts of their being useful in this latitude. I mention the place of my birth only to show the most doubting, that in a more rigorous clime they are extensively used. The breeding of camels is not more expensive than horses.

You, no doubt, are informed with regard to this subject, and I am convinced can give to per-

sons desirous of breeding the camel, valuable information through the medium of your journal. They (the camel,) can be obtained on the Black sea, and if agricultural societies would import a few pairs, they would confer a great advantage on this country.

From 600 to 1000 pounds, with a rider, is a common load for the camel; and the commonest herbage, even weeds and twigs will suffice for their sustenance while enduring the severest labors.

I was advised by some gentlemen, to whom I casually mentioned this subject, to write to some editor of an agricultural paper of this matter, and being about to go to the east through Canada, have thought best to write to you from this place.

H. Boilin.

Buffalo, July 6th, 1842.

SHOEING THE HORSE.

From the Farmers' Cabinet.

Mr. Editor,—The remark of your correspondent at page 318 of your number for May, "That many of us transpose the order of our labors," reminds me of a mode adopted in the shoeing of the horse, which I once witnessed, and which is, I believe, of importance sufficient to deserve notice in the pages of your valuable and very interesting work. It occurred at the town of Croydon, near London, which is known as the centre of stag-hunt, so well attended by the whole country around, and especially by the high-bred bloods of London; and where may be seen a field of the best horses in the whole world—many of them worth their five or seven thousand dollars.

As I once passed through this town, one of my horses' shoes became loose, and I went to the shop of a smith named Lovelace, to get it fastened; the shoe was nearly new, and had become loose in consequence of the nails having drawn out of the hoof, although they had been clinched in the manner universally practised. The smith remarked that all the other shoes were loose, and would soon drop off, when I requested him to take them off and replace them; and then did I perceive the different mode which he adopted for fixing them, which I will here detail. As fast as he drove the nails, he merely bent the points down to the hoof, without, as is customary, twisting them off with the pincers; these he then *drove home*, clinching them against a heavy pair of pincers, which were not made very sharp; and after this had been very carefully done, he twisted off each nail as close as possible to the hoof; the pincers being dull, the nail would hold, so as to get a perfect *twist round* before it separated. These twists were then beaten close into the hoof and filed smooth, but not deep or with the view to rasp off the twist of the nail. "Oh ho!" said I, "I have learned a lesson in horse-shoeing," "Yes," said he, "and a valuable one; if I were ever to lose a single shoe in a long day's hunt, I should have to shut up my shop; my business is to shoe the horses belonging to the hunt, and the loss of a shoe would be the probable ruin of a horse worth, perhaps, a thousand pounds; but I never am fearful of an accident." "Simply, because you drive home and clinch the nails before you twist them off," said I—"Yes," replied he, "by which I secure a *rivet*, as well as a *clinch*." The thing was as clear as the light of day, and I have several times endeavored to make our shoeing-smiths understand it, but they cannot *see* the advantage it would be to *themselves*, and guess, therefore, *it would never do in these parts*; but if my brother farmers cannot see how it works with half an eye, and have not the resolution to get it up into practice, they ought to see the shoes drop from the feet of their horses daily, as I was once accustomed to do. Now, let any one take up an old horse-shoe at any of the smiths' shops on the road, and examine the clinch of the nails which have drawn out of the hoof, and he will soon perceive how the thing operates. In short, if the nails are driven home before twisting off, and the *rivet* formed by the *twist* be not afterward removed by the rasp, I should be glad to be told how the shoe is to come off at all, unless by first cutting out the twist. I am, sir, a constant reader of the Cabinet, and one who has been benefited many dollars by the various hints which have been given in its pages.

J. S.

BUTTER MAKING IN NEW YORK.

From the Maine Cultivator.

Mr. Editor—Business led me to visit Goshen and Minisink, Orange Co., N. Y., in my late journey to that state, and knowing that it was noted through the union as a superior butter making country, I determined to learn every part of the process. I was surprised to find that after the milk is strained, every part of the process differs from ours.

First the keeping of the cows, especially in winter, is somewhat peculiar. When the land is laid down to grass, six quarts of *southern* clover, and as much herds-grass or timothy, is sowed on an acre. This ensures generally a very thick growth of rich pasturage or mowing land. They prefer the southern clover, because it is smaller than ours, and has the advantage, in that the second crop of the season is well seeded, and is the one from which the seed is gathered.

I am convinced from what I saw, that on the average not more than one half the quantity of grass seed is sown in Maine which should be.

They feed their *clover* hay to cows, and I was surprised to see how green they put it into the barn. They say they wish it to be *fermented.*

I visited Gen. Wickomb's yard, in Goshen, where I saw forty cows—all, or nearly all, grade animals of the Durham short-horned breed. Every cow has a separate stall, and outside door, made of three upright boards, with two open spaces, three inches wide, to admit air.

The barn is an L, with a southern aspect. Each door is numbered. In many of the yards I saw boxes for every four cows, made as follows: Four slit-work posts, 5 feet long, at each corner; four side boards, 12 to 15 inches wide and 6 feet long, nailed on so that the lower edge is 20 inches from the ground; a bottom is laid over at this lower edge. From the top of each post there is a board about 4 feet long, coming down on the side board like a brace, and nailed to it; of course there are

eight of these. This forms a place on each side for one animal to feed, and they cannot throw out the straw or hay, which is all put in the box, when the cattle are led in the yard.

I have been thus particular, because I do believe it an important arrangement.

Some raise the sugar beet for winter use.

Now for the butter making. The milk is strained in pans or oaken tubs, holding two pails full. Every thing is done in the cellar. The milk is not meddled with until it *coagulates*, when each day's or each half day's milk is put in the churn, with nearly an equal quantity of cold water in summer, and warm water in autumn or winter, to bring it to the proper temperature, which is from 55 to 66 degrees of Fahrenheit.

The churn is made in the barrel form, of oak, hooped with iron, with a wooden hoop three inches wide at top, in which the cover rests. For six to ten cows, the churn should hold 30 gallons—and in that proportion for a larger number. I believe they rarely exceed two barrels, as in large dairies they prefer to churn several times a day, to the use of larger vessels.

Churning is never done by hand, except for a single cow. In small dairies it is done by a dog or sheep, on an inclined wheel, propelling the dash by very simple gearing. Those larger, have horse or water power. The motion can be communicated to the shaft and arm, elevating and depressing the dash a convenient distance from the moving power, by two wires. For a dog or a sheep, [the latter is preferred, both from economy and efficiency,) a wheel 8 feet in diameter, is inclined about 22° with the horizon, on which the animal is placed, having cleats nailed on to prevent his slipping. No other harness is required than a strap around the neck. His weight is sufficient to move the machine. On the upper side of this wheel is fastened a cast iron cog wheel or circular racket, 3 feet in diameter, which carries a pinion and crank. The wheel is often out door—sometimes in the cellar. It may be in a barn or shed, and the motion communicated by wires, as before stated.

When the butter begins to curdle, as it is called, all is washed down with another pail of water, and the motion continued till the butter gathers. Let it be remembered *the butter is never touched with the hands.* All is done with a short ladle, the blade of which resembles in shape the clam shell, and is five inches across at the end. The handle about five inches long.

The ladle and tray are always kept filled with cold water, when out of use, to prevent the butter from sticking to them.

The butter is worked and salted with the ladle in a tray. When it has stood long enough to become firm, after salting, all the buttermilk is worked out, and it is packed down solid in tubs of 40 or firkins of 80 lbs. If it cannot be made solid by the ladle, a pounder is used. When one churning is put down, a cloth is put on, covered with salt. This is taken off at each addition and replaced, until the tup or firkin is almost full, when half an inch of strong brine is poured over the cloth. Salt is never left between the layers.

They prefer *blown* to *ground* salt, because it is finer, and diffuses itself sooner and more perfectly through the mass; it requires a greater measure, but the same weight.

A churn used daily is cleansed twice a week. The tubs are prepared of oak or ash, and when wet rubbed thoroughly with as much fine salt as will stick on the inside.

Butter thus made and cured will keep for years in a cool place, and sells on an average fifty per cent. higher than butter made in the usual way in our state.

Cows average from 150 to 200 pounds a year, and the buttermilk is estimated to make 100 pounds of pork, which when it brought ten cents, paid all expenses of making the butter—*now*, only half.

Some churn over the buttermilk after standing one day and pouring off the water. One man who had ten cows, told me he made all the butter used in his family in this way, and had 20 lbs. on hand.

This letter may appear both too long and too minute. The subject is a most important one, and I insist on the truth of my assertion last winter, "that the same number of animals now kept, if the dairy were thus managed, would produce in this state 200,000 dollars more than they now do."

JAMES BATES.

Norridgewock, September 28, 1840.

SOWED CORN.

From the New England Farmer.

In 1839 and '40, I sowed corn in drills for *green fodder*. The last and the present year, sowed southern white corn *broadcast*, followed by the harrow and roller. August 6th, with a careful hand cut and weighed the corn on one square yard. The product gave at the rate of 52 tons and a fraction to the acre. August 19th, for the purpose of testing the correctness of the estimate made on the 6th, and also of satisfying myself what might be expected from ground in proper condition to plant for the grain—with a careful and judicious person to assist, we measured and weighed with much care, and found the production was at the rate of 65 tons and a fraction to the acre.

August 22d, cut and weighed	-	229 lbs.
Sept. 28th, the same weighed	-	71 "
Loss,		158

or 69 per cent.; giving, say 20 tons of *dry fodder* to the acre—which if well cured, is considered by some equal to 10 tons *upland* hay.

From one half acre I cut the *second crop*, which was estimated of sufficient value to defray expense of seed and labor for same.

Three bushels of seed, allowing some for the crows, is sufficient

It may be said that the quantity of ground measured was too small to make a correct estimate. I called the attention of my assistant to this point, who was satisfied that it gave a fair result, and one within the reach of any farmer.

GEO. DENNY.

Westboro', October 6th, 1842.

EFFECT OF THE GRAZING OF CLOVER ON ITS MANURING ACTION.

To the Editor of the Farmers' Register.

Agreeably to my promise, I send you the result of an experiment, which was commenced with a view to determine the value of clover as food for hogs, when cut and fed to them.

For this purpose eight pigs, of weights varying from fifty to seventy, were put in an enclosure, and one acre of clover accurately measured off, from a field containing about fifty.

This quantity of land was found more than equal to the supply of as much grass as they would consume; but their improvement while confined to clover alone, was not such as to justify the commendations which have been bestowed upon it.

The experiment, however, disclosed another result, as unlooked for as it was interesting. At the usual season the whole of the field was fallowed, and seeded in wheat. But a short time had elapsed before the boundaries of the acre which had been used for soiling were distinctly defined by the stronger and healthier appearance of the plant, compared with the growth on any other part of the field. The contrast indeed was so striking, that the fact excited a great deal of interest at the time, and various views were suggested to account for it. It was supposed by one, that this lot must have occupied the side of an old garden; and on inquiry, it was ascertained that the former garden did extend over a part, but a very inconsiderable portion of it.

A second ascribed the difference to the great benefit arising from keeping land clean. This circumstance no doubt exerted considerable influence, but did not account for an equal difference in the succeeding crop of clover.

A third suggested it might be owing to the circumstance, that the clover in the one case had been cut at or before the period of flowering, while in the other it had been allowed to arrive at maturity and ripen its seed.

The following extract, from Chaptal's Agricultural Chemistry, would seem to confirm the latter view. He observes that "all farmers know that when they subject to tillage a piece of artificial grass land, which has for several years been constantly mowed at the time of flowering, it will yield several harvests without any dressing; but if the grass has been left to go to seed, it will be necessary to supply the earth with manure, before it will yield a good return."

Thus it appears that clover and the other artificial grasses are eminently fertilizing, if cut at or before the period of flowering, but if allowed to mature their seed, an opposite character must be bestowed, even should the whole of their products be returned to the soil. Plants, it should be borne in mind, are limited to the exercise of two functions, those of nutrition and reproduction, the first being subservient to the second. Here it would seem to be a fair inference, that unless we interpose and avail ourselves of the results of the first, or nutritive stage, the plants will soon enter upon a new series of actions, and appropriate all that is valuable, not to provide for those of a different family, but to perpetuate the species.

WILLIAM L. WIGHT.

Goochland, October 13th, 1842.

THE FLOATING ISLAND IN DERWENT LAKE, NEAR KESWICK, (ENG.)

From the Philadelphia Ledger.

This most extraordinary phenomenon, which has given rise to a multiplicity of opinions as to its cause and properties among geologists and others, including Professor Sedgwick, having again made its appearance, it is apprehended that a short account of it will not only prove amusing to the readers of this paper, but also be interesting to the scientific world generally.

It is situated not far from Lowdore, at the south-east extremity of the lake, and a little more than 150 yards from the land, where the depth of the water does not exceed six feet in a mean state of the lake.

During the last 40 years it has appeared 13 times. In the year 1808, from July 20 to the beginning of October in the same year; in 1813, from the 7th of September to the end of October following; in 1815, from August 5 to the end of the month; in 1819, from August 14 to the end of the same month; in 1824, from June 21 to the end of September; in 1825, it was above the water from the 9th to the 23d of September; and from the 11th July to the end of September in 1826. "The circumstance of its appearing in three successive years," says Mr. Otley, "may be attributed to the extraordinary warmth of the season." It made its appearance again on the 10th of June, 1831, and remained uncovered until the 25th of September. In 1834 and 1835 it was visible for a few weeks in August and September. In 1837 it appeared in July and August. It appeared again on the 19th July, 1841, and remained till the end of August. And it made its appearance in the latter end of last or the beginning of the present month (September,) but it is not yet quite so large as on some of the former occasions of its appearance.

We will not undertake to investigate the great number of hypotheses which have been advanced relative to the cause of this singular phenomenon, nor examine into any of the arguments which have been adduced, but will merely give the opinion of Mr. Otley, who is well versed in the geological and meteorological properties of the lake district, who is resident at Keswick, and who for the last 30 years has watched with much attention the operations of it. Mr. Otley says—

"That it generally rises after an interval of a few days, and after a continuance of fine weather. Its figure and dimensions are variable; it has sometimes contained about half an acre of ground, at other times only a few perches; but extending in a gradual slope under water, a much greater portion is raised from the bottom than reaches the surface of the lake. Several large rents or cracks may be seen in the earth about the place, which appear to have been occasioned by its stretching to reach the surface.

"It never rises far above the level of the lake, but having once attained the surface, it for a time fluctuates with the rise and fall of the water, after which it sinks gradually. When at rest in the bottom of the lake it has the same appearance as the neighboring parts, being covered with the same vegetation, consisting principally of litterella lacustris and lobelia dorimanno, inter-

spersed with isoetes lacustris, and other plants common in this and all the other neighboring lakes; after remaining some time above the water its verdure is much improved. For a few inches in depth it is composed of a clayey or earthy matter, apparently deposited by the water, in which the growing plants have fixed their roots; the rest is a congeries of decayed vegetable matter, forming a stratum of loose peat earth, about six feet in thickness, which rises from a bed of very fine soft clay. A considerable quantity of air is contained in the body of the island, and may be dislodged by probing the earth with a pole. This air was found by Dr. Dalton to consist of equal parts of carbureted hydrogen and azotic gases, with a little carbonic acid."

Mr. Otley farther adds—

"That one material circumstance has, however, generally escaped observation—namely, that the air to which the rising of this island has been attributed is not collected in a body underneath it, but interspersed through the whole mass. And the most probable conclusion seems to be, that air or gas is generated in the body of the island by decomposition of the vegetable matter of which it is formed; and this gas being produced most copiously, as well as being more rarefied in hot weather, the earth at length becomes so much extended therewith as to render the mass of less weight than an equal bulk of water. The water then insinuating itself between the substratum of clay and the peat earth forming the island, bears it to the surface, where it continues for a time, till partly by escape of the gas, partly by its absorption, and partly by its condensation consequent on a decrease of heat, the volume is reduced, and the earth gradually sinks to its former level, where it remains till a sufficient accumulation of gas again renders it buoyant. But as the vegetable matter of which the island is principally composed appears to have been amassed at a remote period, when the lake was of less depth than at present, receiving very little addition from the decay of plants recently grown upon the spot, it is reasonable to suppose that the process of furnishing the gas cannot from the same materials be continued *ad infinitum;* but there must be a time when it shall have arrived at its maximum, after which the eruptions will become less extensive or less frequent."

ON A METHOD OF DESTROYING THE CANKER WORM GRUB.

By John Porter, esq., Newburyport, Mass.

From the Magazine of Horticulture.

Having seen, in your valuable magazine for this month, an article describing the best method for the destruction of the canker worm, I am induced to state the result of an experiment made by myself. The trees on which I tried the experiment had been exposed for five or six years to the ravages of the grubs, without taking any steps to prevent them; and therefore it is fair to infer that the ground contained a bountiful supply for their future operations.

Around each tree I placed a square box, about twelve or fourteen inches high, made of rough boards, leaving a space of four or six inches between the box and the tree. A ledge of about two inches in width was nailed entirely round the top of the box, and the box was inserted two or three inches into the ground, for the purpose of keeping it steady. On the outside of a box, and under part of the ledge, I tarred frequently, and the grubs were thus prevented from ascending from the outside. I filled the inside of the box about two-thirds full of cotton waste (which can be obtained at any cotton manufactory for a cent per pound, or less,) well pounded down, and this effectually prevented them from ascending from the inside. If, however, a few grubs should succeed in getting over the tar from the outside, they have to descend the inside of the box until they reach the cotton waste, and crawl over that until they reach the tree. This they cannot do, as they immediately become entangled by the cotton, and cannot proceed. I have tried this two years in succession, and I have not had a worm on trees, which, for several years previous, had been entirely denuded by this enemy of the apple tree.

The expense is very trifling, as any common boards will answer, and any person who can use a fore-plane, a saw, and a hammer, can easily prepare the boxes.

No possible injury can result to the tree, for the tar does not touch it; and as soon as the season is over for the grubs to ascend, I remove the waste, and spread it to dry for another season, and in this way it will answer for use several years.

I feel entirely satisfied that the foregoing plan will effectually put an end to the ravages of the detestable grub-worm, and I hope that all those who have trees worth preserving, will try the experiment.

THE OHIO EVER-BEARING RASPBERRY.

By A. H. Ernst, Nurseryman, Cincinnati, Ohio.

From the Magazine of Horticulture.

Last spring I had occasion to send a few things to some friends in your vicinity. I availed myself of the occasion to present you with one dozen of the Ohio ever-bearing raspberry plants, which I hope you have received.* I feel some desire to aid in spreading this fruit over the country; less, however, to the *north* than to the *west* or *south*, because your region is more congenial with the growth of the raspberry, and abounds in fine high flavored fruit, of superior quality, which continues to fruit abundantly during the latter part of the summer, so that, to a great extent, the deficiency does not exist with you, which would make this raspberry particularly valuable to your section of country.

The Ohio ever-bearing raspberry, as you are aware, is a native of Ohio. It was, I think, first found and brought into notice by a community of Shakers, residing some thirty miles north-east of this city, from whence, from the best evidence I can procure, it has been very slowly spread into this city and vicinity. To my mind it is valuable

* We did, in excellent order, and Mr. Ernst will receive our thanks for his attention.—*Ed. Mag.*

as a constant bearer; it has none of those claims, however, for superior size and flavor, set up for it. With me, it commences bearing, and ripens its fruit, with most other varieties, in June, which is full and abundant, when it continues to send up a succession of strong and vigorous shoots from the roots of the old plant, which keep up a succession of bloom and maturing fruit the remainder of the summer, not however so profusely as the first fruiting, though of larger size, and, I am inclined to think, of better flavor. This circumstance is, perhaps, owing to the fact, that there is less rain and more sun in the latter part of summer than in June. The fruit is black, strongly resembling the black raspberry of our hills and mountains in size and flavor, and, like it, propagates itself from the ends of the new shoots, which branch just below the cluster of fruit, on the end of the same; those branches grow beyond the cluster of fruit, and bend themselves over to the ground, and again fork, near the end, into several parts; on the ends of these sub-branches roots are formed, which fasten themselves into the ground, and thus form new plants. The roots of the mother plant continue to increase in size and strength, throwing up a greater succession of fruit-bearing stems to occupy the place of the first bearers, which invariadry up after they have performed the office of producing one crop of fruit.

When I say it has no claims to the high reputation for flavor set up for it by some of the writers who have noticed it, I do not mean to be understood as denying it all claim to the same, I only wish to correct what I believe, with due deference to the tastes and judgments of the respectable gentlemen who have written on this valuable fruit, to be an error. My desire is to do it justice, and I think this will be found to be ample, on trial, to recommend it to the favorable attention of the public, and to occupy a conspicuous place in the fruit department of every well selected collection. It cannot fail to prove a valuable kind in the vicinity of all large cities, as a market fruit. To give you some idea of the productiveness of this plant, I counted 105 *berries* in their various stages on the end of *one stem*, forming *one cluster*.

Considerable has already been written on this valuable fruit, but if you think the above will tend to promote its dissemination, and be of interest to your readers, you are at liberty to publish it in your useful magazine.

NEW-ENGLAND BANKING.

Some of the Philadelphia papers are highly extolling the New-England banking system, the conductors thereof being apparently ignorant that it is *in principle* essentially the same as is in the other states, though *the practice* under it is somewhat different. If it has done less harm in New England than in other parts of the union, it is owing to the superior wariness of the New-England character, and owing to circumstances there being less favorable to the display of such financial skill as has raised Pennsylvania and some other states into an unenviable kind of notoriety.

The wariness of the New-England character, has led the people of that part of the country to eschew the branch bank system. The stock of each bank is owned chiefly by the inhabitants of the village in which it is situated, and the bank is generally managed by those who have a deep interest in keeping the capital sound. In this respect the New-England system of banking is far preferable to that which prevails in Virginia and some other states.

The same wariness of character has led the New-England men to a prompt settlement of bank balances.

In New-England, real capital is more abundant in proportion to the means of employing it than in other parts of the union. There is consequently less opportunity for the display of financial skill by operating on what is called "factitious capital."

In New-England, moreover, every thing is in a settled state compared with most other parts of the country. Society there is fifty years older than it is in Pennsylvania, and a hundred years older than it is in some of the other states. Paper money banking naturally leads to the greatest excesses, in those parts of the country the natural resources of which are in a rapid state of developement, as in Illinois and Mississippi. It is comparatively moderate in its action in long established, well compacted communities.

In the many crises which we have passed through, New-England has enjoyed great advantages, through New York, Philadelphia, and Baltimore, being guaranties in a manner of the sales of goods she made to the south and west. Besides this, New-England was less exposed than other parts of the union to the deleterious influences of the United States Bank.

Notwithstanding all this, paper money banking is operating on society in New-England like a subtle poison, and so those New-Englandmen as have carefully and candidly inquired into the system are well convinced. One of the most intelligent of the merchants of Boston told us not long since, that when he first read our History of Banking, he thought we had exaggerated the evils of the system, but subsequently observation had convinced him that our representations fall short of the awful reality.

In the state of New Hampshire, which contains fewer inhabitants than the city of New York, and not many more than the city and county of Philadelphia, upwards of one thousand persons have applied for the benefit of the bankrupt act. This fact alone shows that there is something radically wrong in the currency and credit system of New-England.

Nothing but gross ignorance, or inveterate prejudice, or a strong desire to speculate on the rest of the community through some new modification of the paper money system, could ever induce a man to offer New-England banking as a model for the rest of the union. It is, we repeat it, in its *principles*, essentially the same as that which has ruined Mississippi and Michigan, and disgraced Pennsylvania.—*Gouge.*

AGRICULTURAL LETTER FROM GEN. WASHINGTON TO HIS OVERSEERS.

From the Farmers' Gazette.

We are indebted to the kindness of an old friend for the following valuable document; valuable not only because of the revered source from which it emanates, but because it affords many excellent lessons from an able and practical farmer; it is too strongly characteristic of the American hero. We see here the exercise in private life of that attention to detail, that inflexible devotion to order and discipline, which so eminently mark the public character of Washington. No one can read this letter without seeing at once that the writer was an industrious, sound, *practical* farmer. He, whose indomitable energy had given freedom to a world, did not esteem the most minute details of agriculture unworthy his attention.

It will probably surprise the reader to find Gen. Washington insisting upon the use of harrows and cultivators in the cultivation of his corn; this we have been accustomed to plume ourselves upon as a much more modern invention.

This letter, directed to his overseers, is taken from the manuscript copy in Washington's own hand writing, and as we are informed, now appears in print for the first time.

Philadelphia, 14th July, 1793.

Gentlemen.—It being indispensably necessary that I should have some person at Mount Vernon through whom I can communicate my orders; who will see that these orders are executed; or, if not obeyed, who will inform me why they are not; who will receive the weekly reports and transmit them; receive money and pay it; and in general to do those things which do not appertain to any individual overseer—I have sent my nephew, Mr. Howell Lewis, (who lives with me here,) to attend to them until I can provide a manager of established reputation in these matters. You will, therefore, pay due regard to such directions as you may receive from him, considering them as coming immediately from myself. But that you also may have a general knowledge of what I expect from you, I shall convey the following view (which I have of the business committed to your charge) as it appears to me, and direct you to govern yourself by it: as I am persuaded nothing inconsistent therewith will be ordered by Mr. Lewis, without authority from me to depart from it.

1st. Although it is almost needless to remark that the corn ground at the farm you overlook ought to be kept perfectly clean and well ploughed—yet, because not only the goodness of that crop depends upon such management, but also the wheat crop which is to succeed it, I cannot forbear urging the propriety and necessity of the measure in very strong terms.

2d. The wheat is to be got into the barns or into stacks as soon as it can be done with any sort of convenience, that it may not (especially the bearded wheat, which is subject to injury by wet weather,) sustain loss in shocks—and because the shattered grain in the fields may be beneficial to the stock; but no hogs are to be put on stubble fields in which grass seeds were sown last fall, winter or spring; other stock, however, may be turned on them, as it is rooting that would be prejudicial.

3d. The whole swamp, from the road from Manley's bridge up to the lane leading to the new barn, is to be got into the best and most complete order for sowing grass seeds in August—or, at the farthest, by the middle of September. The lowest and wettest part thereof is to be sown with timothy seed alone. All the other parts of it are to be sown with timothy and clover seeds mixed. The swamp on the other side of the aforesaid lane (now in corn and oats) is to be kept in the best possible order, that the part not already sown with grass seeds, may receive them either this autumn (as soon as the corn can be taken off with safety) or in the spring, as circumstances shall dictate.

No exertion or pains are to be spared at Dague-run to get the swamp from Manley's bridge up to the meadow above, and the two enclosures in the mill swamp, in the highest order for grass, to be sown in the time and manner above mentioned. But that no more may be attempted than can be executed well, proceed in the following order with them, accordingly as the weather may happen to be, for this must be consulted, as dry weather will answer to work in the low parts best, whilst the higher grounds may be worked at any times.

1st. Begin with the swamp from Manley's bridge upwards, and get all that is not already in grass well prepared for it, and indeed sown. 2d. That part of the lower meadow on the mill run, which lies between the old bed of it and the race, and within the fences. 3d. After this is done, take that part in the enclosure above (which was in corn last year) lying between the ditch and fence of No. 1, up and down to cross fences. 4th. Then go over the ditch and prepare slipe after slipe as the ditch runs from the one cross fence to the other, and continue to do this as long as the season will be good, or the seed can be sown with propriety and safety.

I conceive that the only way to get these grounds in good order and with expedition, is to give them one good ploughing and then to tear them to pieces with heavy harrows. Whether it be necessary to cut down and take off the weeds previous to these workings can be decided better by experiments on the spot than by reasoning on it at a distance. My desire is that the ground shall be made perfectly clean, and laid down smooth; without which meadows will always be foul—much grass left in them, and many scythes broken in cutting what is taken off.

4th. The buckwheat which has been sown for manure ought to be ploughed in the moment a sufficiency of seed is ripe to stock the ground a second time; otherwise, so far from its answering the purpose of manure, it will become an exhauster. For this reason, if the ploughs belonging to the farm are unable to turn it in time, those of Muddy hole, Dague run and Union farm must combine to do it, the work to be repaid by the farm which receives the benefit, as soon as the work is accomplished thereat.

5th. Where clover and timothy seeds are mixed and sown together, allow five pints of the first, and three of the latter to the acre; and where timothy only is sown, allow four quarts to the acre. Let the seed be measured in the proportions

here allotted and put into a half bushel, and the half bushel filled with sand or dry earth, and extremely well mixed together in your own presence or by yourself, which will answer two good purposes, viz.: 1st, to prevent theft, for seeds thus mixed, would not sell—and 2dly, the seedsman being accustomed to sow a bushel of wheat to the acre would be at no loss to cast a bushel of this or any thing else, regularly on that quantity of ground.

6th. It is expected you will begin to sow wheat early in August, and in ground perfectly clean and well ploughed. I would have, and do accordingly direct, that not less than five pecks of seed be sown on each acre. The plan of the farm over which you look is given to Mr. Lewis, from which the contents of each field may be known. And it is my express direction that every watch and the best attention may be given, to see that this quantity actually is put in; for I have strong suspicions (but this ought not to be hinted to them) that the seedsmen help themselves to a pretty large toll.

7th. As soon as you have done sowing, and even before, if it can be done conveniently, you are to set heartily about thrashing or treading out the wheat; and as fast as it is got out, to have it delivered at the mill or elsewhere, according to directions. The longer this business is delayed, the more waste and embezzlement will there be of the crop. The wheat is to be well cleaned; the chaff and light wheat are to be properly taken care of for the horses or other stock—and the straw stacked and secured as it ought to be against weather and other injuries; and until the whole be delivered it will require your constant and close attention.

8th. The oats at the farm you overlook are, I presume, all cut; in that case, let all the scythes, and cradles, and rakes which you have received, be delivered over to the mansion house; or if you choose to keep them against next harvest, you must be responsible for them yourself.

9th. The presumption also is, that the flax is, ere this, pulled; let it be well secured, and at a proper season stripped of its seed and spread to rot. During this operation let it be often turned and examined, that it be not overdone, or receive injury in any other respect by lying out too long.

10th. Get the cleanest and best wheat for seed, and that which is freest from onions. I would have about one third of my whole crop sown with the common wheat; one third with the white; and the other third with the yellow bearded wheat. The overseers (with Davy, as he knows the state of his own farm and the quality of the wheat which grows upon it,) may meet and decide among themselves whether it would be best to have some of each of these sorts on every farm; or, in order more effectually to prevent mixture, to have one sort only on a farm. In the latter case, the cutting of that which ripens first, and so on, must be accomplished by the force of all the farms, instead of each doing its own work. If the seed on one farm was to be sown on another, especially if seed which grew on a light soil was to be sown on a stiff one; and that which grew on a stiff one sown on light ground, advantages would unquestionably result from it.

11th. The potatoes at the mansion house must be worked by the ploughs from Union farm, and when this is required, it would be best, I conceive, to accomplish the work in a day.

12th. It is expected that the fences will be made secure, and no damage permitted within them by creatures of any kind or belonging to any body—mine any more than others.

13th. The greatest attention is to be paid to the stocks of all kinds on the farms; and the most that can be made of their manure and litter.—They are to be counted regularly, that no false report may be made; and missing ones, if any, hunted for until found, or the manner of their going can be accounted for satisfactorily.

14th. A weekly report, as usual, is to be handed to Mr. Lewis. In this report, that I may know better how the work goes on, mention when you begin to plough, hoe, or otherwise work in a field, and when that field is finished. The increase, decrease and changes are to be noted as heretofore—and let me ask

15th. Why are the corn harrows thrown aside, or so little used that I rarely of late ever see or hear of their being at work? I have been run to very considerable expense in providing these and other implements for my farms: and to my great mortification and injury, find, generally speaking, that wherever they were last used there they remain, if not stolen, till required again; by which means they, as well as the carts, receive so much injury from the wet weather and the heat of the sun as to be unfit for use; to repair or supply the place of which with new ones, my carpenters (who ought to be otherwise employed) are continually occupied in these jobs. Harrows, after the ground is well broken, would certainly weed and keep the corn clean with more ease than ploughs. I hope, therefore, they will be used. And it is my express order that the greatest care be taken of the tools of every kind, carts and plantation implements, in future—for I can no longer submit to the losses I am continually sustaining by neglect.

16th. There is nothing I more ardently desire, nor indeed is there any more essential to my permanent interest, than of raising of live fences on proper ditches or banks; yet nothing has ever been, in a general way, more shamefully neglected or mismanaged; for, instead of preparing the ground properly for the reception of the seed, and weeding and keeping the plants clean after they come up—the seeds are hardly scratched into the ground, and are suffered to be smothered by the weeds and grass if they do come up: by which means the expense I have been at in purchasing and sending the seeds (generally from Philadelphia) together with the labor, such as it is, that has been incurred, is not only lost, but (and which is of infinite more importance to me) season after season passes away and I am as far from the accomplishment of my object as ever. I mention the matter thus fully to show how anxious I am that all those seeds which have been sown or planted on the banks of the ditches should be properly attended to; and the deficient spots made good, if you have or can obtain the means for doing it.

17th. There is one thing I must caution you against (without knowing whether there be cause to charge you with it or not)—and that is not to retain any of my negroes who are able and fit to work in the crop, in or about your own house, for your own purposes. This I do not allow any

overseer to do. A small boy or girl, for the purpose of fetching wood or water, tending a child, or such like things, I do not object to; but so soon as they are able to work out I expect to reap the benefit of their labor myself.

18th. Though last mentioned, it is not of the least importance, because the peace and good government of the negroes depend upon it—and not less so my interest and your own reputation. I do, therefore, in explicit terms, enjoin it upon you to remain constantly at home, (unless called off by unavoidable business or to attend Divine worship,) and to be constantly with your people when there. There is no other sure way of getting work well done and quietly by negroes; for when an overlooker's back is turned the most of them will slight their work, or be idle altogether. In which case correction cannot retrieve either, but often produces evils which are worse than the disease. Nor is there any other mode but this to prevent thieving and other disorders, the consequence of opportunities. You will recollect that your time is paid for by me, and if I am deprived of it, it is worse even than robbing my purse, because it is also a breach of trust, which every honest man ought to hold most sacred. You have found me, and you will continue to find me, faithful to my part of the agreement which was made with you, whilst you are attentive to your part; but it is to be remembered, that a breach on one side releases the obligation on the other. If, therefore, it shall be proved to me that you are absenting yourself from the farm or the people without just cause, I shall hold myself no more bound to pay the wages than you do to attend strictly to the charge which is entrusted to you by one who has every disposition to be your friend and servant,

GEO. WASHINGTON.

MARL AND SOFT LIMESTONE OF SOUTH CAROLINA. "CHALK HILLS" IMPROPERLY SO CALLED. NEW JERSEN GREEN SAND.

[The inquiries in regard to South Carolina, which drew forth the following letter, will be sufficiently set forth by the answers. One of our inquiries was caused by information very lately received as to the existence of what was called "chalk" in large quantities near Hamburg. This we supposed to be indurated and very pure marl, or soft lime-stone; but it appears from Mr. Vanuxem's letter that the earth in question is merely a clay, containing no calcareous matter. In correcting this mistake, (under which we know that some intelligent persons still remain,) as well as in the statements of the localities and kinds of actual calcareous deposites, this letter may be valuable to many persons in South Carolina; and this we trust will excuse us to the writer for publishing it without any omission, or alteration of form as he mentioned, but which we did not deem necessary. One change of form only we would have desired, but could not always supply—and for the want of which we fear injustice may be done the writer's meaning in some minor respects. Because of the haste of the writing, some of the words of the letter were illegible, and possibly their equivalents may not have been rendered by substitution in the printing.—ED. F. R.]

To the Editor of the Farmers' Register.

Bristol, October 8th, 1842.

Dear sir,—I read your letter of the 28th ultimo, and a few pages of the Farmers' Register, containing an account of your visit to some parts of the "marl" region of New Jersey, which I have read with interest. In reply to your letter requesting a copy of the report on the geology of South Carolina, I regret that I cannot lay my hands upon the two only copies which I have, one of which you would be welcome to, though it would not give you any of the information you seek, as it was the report of a short season, and relates only to the west part of the state, which is entirely in the primary region, and the opposite extreme of the "calcareous marl" region. The report, like all the legislative documents of that state, was published only in the two newspapers of Columbia, which is one of the reasons why that survey is so little known. The region which contains the "soft lime-stone," makes its appearance generally, from about twenty to thirty miles east of the mail route through Cheraw, Camden, Columbia and Hamburg, extends to near the seacoast, the "soft limestone" appearing at the surface at intervals in that part of the state, from not being a homogeneous deposite, from being covered with newer deposites, and from the underlying or "green-sand" deposite appearing also in that belt of country, as for example at Mars' Bluff, on Pee Dee river, Waccamaw river, in Horry district, Effingham's mill, near Eutaw Springs, on Santee river, and (if Bartram can be relied upon,) in the river at Silver Bluff, below Augusta or Hamburg, which place I visited, but could not find what he discovered, though the water might have been unusually low when he was there. The localities of "soft limestone" which I visited were but few in number. The first was Dr. Jameson's quarry, on the road from Orangeburg court house to McCord's ferry on the Santee. It is very white, has the appearance of a hard chalk, is burnt for lime, and is among the purest which I examined, containing 91.6 carbonate of lime, 8.4 of argile [the pure matter of clay] chiefly. It abounds in the *ostrea selliformis*.

The same but not so white was also burnt for lime on Mr. Darby's plantation in St. Matthew's parish. Two specimens were examined, one gave—

Carbonate of lime - - -	90.4
Argile and oxide of iron - -	9.6

The other, which was purer,

Carbonate of lime - - -	92.2
Argile and oxide of iron - -	5.8

Among some of the other localities which came under my notice, and from which I received specimens, but did not visit, were Eutaw springs, Godfrey's ferry on the Pee Dee river, Swain's ferry on the Edisto, Santee canal, &c. One of the finest expositions of the "soft limestone" and which will one day be of great value for agricultural

purposes, from its position, mass and exposition, is Shell Bluff on the Savannah river. It rises abruptly from the edge of the river, (and is about 25 miles below Augusta, on the Georgia side.) The height judged to be above fifty feet. In a section which I made of the bluff near 16 or 17 years ago, I divided the calcareous mass into 14 parts or portions, one resting upon the other, the whole being covered with a red earth, usually sandy, and which is common to most of the seaboard portion of the states south of the Chesapeake. Specimens from each of these 14 divisions were examined for that part only combined with carbonic acid, the impurities being considered of no practical moment; and from position and some slight examination, the part combined with the acid is believed to be lime, and lime only. The results probably may be of advantage to some of the readers of your Register and they are given, having never been published.

No. 1. Commencing at the water line, two specimens, one from the lower part gave
- Carbonate of lime - - - - - 47.2
- Sand and argile - - - - - 52.8

The other from the upper part
- Carbonate of lime - - - - - 71.6
- Light yellow argile very plastic - - 28.4

No. 2. Mass of comminuted shells:
- Carbonate of lime - - - - - 73.2
- Argile and some course sand (transparent) - - - - - - - 26.8

No. 3. Similar mass (with disintegrated shells:
- Carbonate of lime - - - - - 62.4
- Coarse silicious sand and yellow clay 37.6

No. 4. Similar mass:
- Carbonate of lime - - - - - 73.2
- Coarse sand and yellow argile - - 26.8

No. 5. Bed about 6 inches thick, distinctly observed in the bluff:
- Carbonate of lime - - - - - 37.2
- Light olive colored argile and fine and coarse sand - - - - - - 62.8

No. 6. Comminuted shells, &c., and occasionally an entire one:
- Carbonate of lime - - - - - 47.2
- Glassy sand and yellow argile - - 52.8

No. 7. The same:
- Carbonate of lime - - - - - 85 2
- Glassy sand and yellow argile - - 14.8

No. 8. The same. More arenaceous:
- Carbonate of lime - - - - - 54 4
- Glassy sand and ochery argile - - 45.6

No. 9. Earthy or marly:
- Carbonate of lime - - - - - 80.4
- Same kind of sand, argile or clay - 19.6

No. 10. Very thick bed:
- Carbonate of lime - - - - - 64.4
- Glassy sand and whitish argile - 35.4

No. 11. In nodules and large flat masses:
- Carbonate of lime - - - - - 93.4
- Yellowish white argile - - - 7 6

No. 12. Comminuted shells, &c., with occasionally a large oyster:
- Carbonate of lime - - - - - 83.2
- Coarse sand and yellow argile, very tenacious - - - - - - 16.8

No. 13. Abounds in impressions of tertiary shells but the shelly part remained:
- Carbonate of lime - - - - - 77.6
- Ferruginous argile, very soft - - 22.4

No. 14. Upper part of the calcareous bluff abounds in large ostrea which are collected and burnt for lime. Bed about 6 feet thick. I did not analyze their matrix, but have no reason to believe that it varies from those immediately below it.

Having given you as much information as I have at hand, in relation to the "soft calcareous region," and believing it to be to the purpose for which you write, I will now pass to the next item of your letter, namely, the supposed chalk hills, near Hamburg, in South Carolina. This chalk is a remarkably pure clay, as to color and composition, for its position and mass, and is found at intervals from Long Island to Florida, but usually associated with red clay, forms the mass which you may have seen at Fort Washington on the Potomac. It is in greater body, and a finer white, between Columbia and Augusta, than I have elsewhere noticed it. It would be a porcelain earth were it not for a yellow tinge which it exhibits when burnt, owing to oxide of iron, from which it requires only to be free to rank with that substance. Through the region where it exists, its hillocks are called chalk hills. It occurs always near the line of the primary range going from the ocean, and appears to have been derived from the decomposition of the feldspar of the granite, which from Virginia south is the prevailing seaboard primary rock. To the south the clay is usually covered with a red ferruginous earth, with coarse sand, which is an abundant sub-soil along the southern mail route, and for some distance to the east of it, being often covered with white coarse hyalic or glassy quartz sand, the common sand of the Atlantic region.

I regret that when in Philadelphia you did not visit me. I should greatly have been pleased to have made your personal acquaintance, to have shown you our loamy soils upon which lime acts so beneficially, and to have accompanied you into some of the more eastern marl regions of the state than those you visited. I should like to have had some conversation with you upon the improvement of soil, for little can be given in a letter in comparison with oral communication. Your paper in the pages of the Farmers' Register adds more proof to the opinion which I entertain and entertained, of the action of New Jersey "marl," that it is not a specific, (hence potash is not the fertilizing principle, as asserted,) but acts favorably only under certain circumstances. Thus the gunpowder variety, whose particles are evident, is valuable when applied to stiff, or adhesive, or wet soils, whilst the coherent ones are beneficial upon the more open and sandy ones, as you instanced on some of the farms in Gloucester county. It is more easy for me to generalize, or find a final cause than a proximate one, for *New Jersey marl*, namely, that all production whatever is the result of difference, and that production ceases so soon as all differences are removed or cease; hence, with me, rotation is the first and essential element in all good farming, being in accordance with the whole plan of creation, as developed in geology and revelation. One thing prepares the way for another—an order of succession having been established from all eternity. Take a worn-out field in this section of country, where no wheat has been grown for twenty years, and with a little manure it will yield 25 bushels to the acre; whereas previously it would not produce ten with

the same manure. When abandoned it would produce nothing but weeds, and finally coarse or stunted grasses; for the light particles of soils having been carried below by the action of rain, which leaves only the coarser ones upon the surface, some other grasses appear, and these prepare the soil to again yield wheat, which without lime, manures, and a certain succession, the land would again become unproductive to the cultivator. I find on my farm, that whatever I put on it that is foreign to the soil, and is not poisonous, improves it either directly or indirectly. Hence the great advantage of continuously deeper ploughing, which I have practised from the beginning now twelve years. It is certain that change is good for man and the whole class of animals; it is so for plants, and for soils to be productive they must undergo a change likewise; and thus mixtures of earths, manures, green crops, saline substances to act as condiments or stimulants, gaseous absorbents, like charcoal, &c., are beneficial. In a paper which was published in the Journal of the Academy of Philadelphia, 1828, I there mentioned that the marl of New Jersey and Delaware yielded but an inconsiderable portion of carbonate of lime, and that it appeared to owe its fertilizing property to a small quantity of iron pyrites, which passes to sulphate of iron by exposure to the air, and also to animal matter, to its color, and to its effects, when mixed with sand, of diminishing the calorific conducting power of the latter. I was then not aware of the potash which was contained in it, or should have noticed it.

In the Report which I recently published, in Albany, under the head of "soils," are these words: "Certain earthy mixtures which contain no nutriment, such as the marl of New Jersey, possess a highly fertilizing quality, the efficient cause of which is yet unknown, for it cannot be the potash contained therein, as was formerly supposed, since in that case micaceous or primary soils would be more productive than they are. Too little attention, it seems to me, has hitherto been given to the effects developed by the action of the sun's rays on different colored particles in the soil: the white particles producing reflection in excess, may give rise to a repellent force; while the darker colored ones, being less reflective, receive the full influence of the calorific ones, and thereby evolve that force connected with combination. By the assiduous study of the law of these two forces which have a close analogy to the powers of life, we would probably do more to remove the difficulty in question, than by following any course hitherto pursued."

With respect to potash, I must state that in a more recent conversation with Professor Booth he informed me that carbonic acid would separate the alkali from the marl, which consequently gives the marl an advantage over micaceous soils, as respects potash, the mica requiring a much stronger acid to act upon it.

This letter is written as a kind of interchange for what you sent me. Should any part other than those which are a reply to your letter be of use to you as an editor, they are at your service, but will require your aid to be fitted for publication. The information you ask for, I take for granted you wish to publish, though that may require some alteration as to manner. With great respect,

LARDNER VANUXEM.

To the Editor of the Farmers' Register.

A STATEMENT OF THE NUMBER OF ACRES OF LAND WHICH HAD BEEN MARLED IN THE COUNTY OF KING WILLIAM, AT THE TIME OF TAKING THE CENSUS IN 1840.

Showing the amount marled by each person.

ACRES.	ACRES.	ACRES.	ACRES.	ACRES.
16	150	40	100	230
100	200	1	60	30
40	5	1	180	440
150	6	600	20	15
2	35	300	35	63
50	12	100	10	12
100	50	80	30	85
80	20	50	20	750
30	60	100	25	100
300	300	300	75	150
100	4	60	75	150
10	400	50	200	100
20	5	12	170	50
14	75	2	20	30
300	115	30	10	15
75				

Total 7800 acres.

A true copy, from the books of George N. Powell, the person by whom the census was taken in 1840. HARDIN B. LITTLEPAGE.

In addition to the above amount, the following persons were not enumerated:	7800 acres.
Maj. Dabney, up to 1840, had marled	40
James Fox, Upper Farm, - -	400
" " Queenfield, - -	150
Mr. Latane - - - - -	100
Mr. Berkeley, - - - -	100
Wm. Ryland, - - - -	15
Mrs. S. Tuck, - - - -	20
Edward Hill, - - - -	40
John F. McGeorge, - - -	25
Dr. Nelson, - - - - -	20
Col. B. F. Dabney, - - -	10
Dr. Corbin Braxton, - - -	600
Wilson C. Pemberton, - -	50
	9370

Above you will see, by an extract of Mr. Hardin B. Littlepage, from the books of Mr. George N. Powell, who was the census taker for this county, that the number of persons who had marled land up to June 1840, were 76; and the number, of acres marled were 7800. In addition to these, there were 13 farmers who were not requested by Mr. Powell to state how much land was marled, the extent of whose marling was 1570 acres; making in the aggregate 89 persons who had used marl up to 1840, and the extent of whose marling was 9370 acres. Since 1840 I suppose almost as much land has been marled as was marled prior to that time. I regret that Mr. Littlepage did not set down the names of the persons as I have done.

You can give in your own words the result of the above in the November Register. I requested Mr. Powell to take the census of the marled lands in the county, in consequence of your circular, asking information on the subject.

WM. SPOTSWOOD FONTAINE.

ESTIMATE OF THE INCREASED VALUE OF PROPERTY IN KING WILLIAM COUNTY, CAUSED BY MARLING.

The foregoing article, even though incomplete and imperfect, is a valuable contribution to the agricultural statistics of Virginia. We have in vain endeavored to procure similar statements from other marling counties; and we trust that this communication (for which we are indebted to the public spirit of Messrs. Fontaine and Powell) will induce sundry others of our friends, in different counties, to follow the example thus furnished. If the legislature would require a list of marled and limed lands to be taken by the commissioners of the revenue next spring, when taking the lists of taxable property, such a statement would be full and correct, and it would show a general result of value already derived to Virginia from these sources very far exceeding what most persons would suppose.

Though the names of all the individuals who had applied marl were set down by Mr. Powell, the taker of the census, unluckily the clerk did not deem it necessary to copy them. This we very much regret. It would add much to the interest of such documents, and especially when they shall be read in future times, for them to show who were the persons who had made the earliest progress in marling, and also the lands on which they labored, as well as the extent of land thus improved. The latter is indeed by far the most important point—and that is doubtless correctly stated in the foregoing list. Upon these unquestionable data we shall construct and submit some calculations of profit and value.

Without taking into consideration any land marled since, it appears that there had been marled, at the close of 1840, in the small county of King William, 9370 acres. Let us endeavor to estimate, upon sure grounds, what is the consequent increase of net profit and of permanent value, to the proprietors of the land.

As the three-shift rotation is the most general, let us suppose it to be the one in practice on these marled lands; the course of crops being 1, corn, 2, wheat, (or oats,) 3, clover, or natural grass and weeds where the sowing of clover is neglected. For all details, I will adopt the general estimate given at page 120 of the new edition (now in the course of publication) of the 'Essay on Calcareous Manures,' the sheet containing which estimate will accompany this number, and to which the reader is referred for any particulars not here mentioned or made clear. Applying that general estimate to the marled lands of the county of King William, and assuming the *increased* net product of corn per acre to be 10 bushels, and of wheat, 5 bushels, then the statement of actual general increased profit, and value derived as early as 1841 will be as follows;

In corn, one third of 9370 acres, or 3123 acres, of which the *increased net product*, (caused by marling) is on an average 10 bushels per acre=31230 bushels, at 50 cents= - -	$15.615
One third, or 3123 acres, in wheat, yielding on the average of *increased net product* 5 bushels per acre=15615 bushels, at $1, (or if in oats, equal value)= - - - - - -	$15.615
One third, 3123 acres, in clover or weeds, and counted as yielding no pecuniary value, - - - - - -	00.
Total net annual profit from marling, then accruing, - - - -	$31.230

As this net annual increase will without question be permanent, (under the course of culture supposed) for all future time, this amount of clear profit may be assumed as certain for every year thereafter—without counting any thing for the still growing effects of the same marlings, or of the further extension of marling. And therefore, this sum of $31.230 is but the annual interest of the capital sum by which the property of the marlers of King William had been increased in 1840. The capital which would yield this interest, at 6 per cent., is $520,500; and, according to our grounds of estimate, that was the *increased* wealth then already produced. The extent of surface marled in 1840 will probably be tripled in ten years, and the increased net product of each acre, in some future time, made double what is stated above—so that it is not improbable that the increased value of capital, and of intrinsic value, supposed to be $520,500 for 1840, will hereafter grow to six times that amount, or more than $3,000,000.

But though the above *annual increased product* would be all *clear profit* on the cultivation, (of which all the increased expenses were supposed to be paid,) still when estimating the increased value of capital, the cost of the investment should be deducted. That cost is the expense of the marling. This varies with every operation; but it is probable that $4 the acre would be an ample allowance for the average cost of all the marling above stated. This, for 9370 acres, would be $37,480, which should be deducted from the newly created capital of $520,500, leaving of it $483,020 clear gain, in 1840.

If taking another view, the whole expense of marling will on the average be more than paid for by the net increase of crop made the first year of cultivation—leaving thenceforward all the newly created value of land so much of clear profit made by the marling.

These and all such estimates may be pronounced by most persons to be extravagant and incredible; but it will not be by those who have had most experience of the results of *judicious* marling. It is indeed assumed, in the foregoing estimate, that the marling was, and the subsequent culture is judiciously conducted. If otherwise, then so far the profit may be deficient, and the estimate will be erroneous. But the estimate was not designed for injudicious marling, nor for exhausting or destructive tillage. If all the farmers who have marled in King William have not fully realized the values estimated above, it is the fault of their management, and not of the marl, or of its proper use.

"AMENDE HONORABLE."

To the Editor of the Farmers' Register.

Big Lick, Roanoke, October 11, 1842.

In your September number, which has just reached me, I observed a letter from Mr. Turner, in which he declines a regular reply to my last piece, as presenting nothing to which he had not already replied, save a large infusion of "insulting epithets and coarse figures." I am free to confess that there is a good deal of truth in this censure, and I sincerely regret that I should have been driven by circumstances into a style of composition so opposed to my own taste, and so illy suited to an agricultural journal. Courtesy, kindness, and charity, should above all distinguish the discussions of farmers, between whom there can be no conflicting interests, and whose sole aim should be an increase of the general stock of knowledge and their mutual prosperity. All communications which violate these distinguishing characteristics are properly excluded from publication, but when from oversight or any other cause they are admitted, and the feelings of individuals thereby wounded, justice requires the privilege of a reply. Whether I have been "most sinned against or sinning," in this controversy, I am perfectly willing to leave to the decision of the public upon the essays as published.

Acting under the restriction which you imposed upon me, I have carefully avoided every thing offensive in this letter, which I desire you to publish as a sort of "*amende honorable*" to your numerous intelligent subscribers for the disrespect which I have shown them, in filling the valuable pages of the Register with the satirical badinage and coarse epithets of a heated personal controversy. Yours respectfully,

W. M. PEYTON.

ON THE CULTIVATION OF THE RASPBERRY.

By C. M. Hovey, esq., Editor of the Magazine of Horticulture.

In our last number we gave an article on the cultivation of the currant. It was the first of a series of papers we intend to offer upon the cultivation of all the fruits of the garden, which have not been previously written upon by ourselves. We now proceed to treat upon the growth of the raspberry.

The raspberry, like the strawberry and currant, and other small fruits, the gooseberry excepted, has been greatly neglected in its cultivation. Though common in every garden, and every where esteemed, next to the strawberry, for its rich and handsome fruit, yet few individuals have attempted improved methods of growth, by which the size, beauty, excellence, and productiveness of the berries may be increased to a much greater degree than they are generally seen in our gardens.

The raspberry is as susceptible of improvement as the strawberry: yet, while in the latter we have the beautiful Keen's seedling and our own variety, contrasting with such marked superiority over the small and inferior berries of the older sorts, the same varieties of the raspberry are now cultivated that were common twenty or thirty years ago, and they are still deemed the most desirable sorts. The same attention bestowed on this fruit, that has been devoted to the gooseberry, would undoubtedly have resulted in the production of varieties much superior to those at present grown.

The raspberry, like the strawberry, is a native of low and partially shady situations, growing in boggy or soft black soils, which allow its roots to strike deep, and throw up a free growth of its vigorous suckers. It is only in such situations, in their wild state, that the plants are found productive; on light and thin soils, and in high and exposed situations, the growth of the suckers is limited, and the fruit scarcely ever attains any size. Nature thus teaches the proper mode which the cultivator should adopt in the growth of the plants; and it should be his object to follow her, rather than to divert and thwart her in the course she has pointed out for us to pursue.

But how different is the cultivation of the raspberry from what we should infer from nature to be most conducive to its healthy growth. The plants are frequently set out in light and poor soils, crowded together, left untrimmed, choked up with a profuse growth of weak stems, and what little fruit they produce nearly dried up, from the arid situation in which they are placed. On the contrary, in cool, deep, and moist soils, in a sheltered and partially shaded place, the plants throw up suckers to the height of six or eight feet, and produce a profusion of large, handsome, and well flavored berries. So well assured are the most eminent English cultivators of the raspberry, of its love of a cool and moist soil, that some writers have strenuously recommended the use of bog earth and rotten leaves, in the place of the richest loam. We are well assured that the many complaints which are made of the meager produce of many raspberry plantations, may be attributed wholly to the light and droughty soils in which they are often planted.

We would not here omit to mention the pro-

duction of seedlings for the purpose of securing new sorts. By hybridization of the kinds, and by selecting the finest and largest fruit, from which to save the seeds, we are certain new and superior varieties can be raised.

To induce cultivators to give more attention to the raspberry, is the object of this article; and, to render our information the more useful, we shall treat of its growth under the following heads:—situation—soil—procuring plants—planting out—winter treatment—summer treatment—autumnal dressings—pruning—general remarks—and descriptions of the different varieties.

Situation.—A cool aspect is of material consequence; and to secure this, the north side of a fence or trellis, which will form a screen from the sun, is the most favorable; on the north side of a shrubbery, or row of fruit trees, is also a suitable place. If neither of these situations are to be had, an open spot in the garden may be chosen, always being careful to avoid the south or east side of a fence. A temporary shade may be effected in the open garden, by planting a row of running beans on the south side. Having selected a proper place, proceed to prepare the soil.

Soil.—A good soil is the most important requisite. Having marked out the size of the bed, if the earth is not naturally very rich and deep, preparations should be made to trench it. First cover the surface with three or four inches of bog earth, if to be procured, or, in its place, leaf soil, and if these are not conveniently to be had, good old rotten hot-bed manure, which has laid at least six or eight months: that from hot-beds made in April will do for use in the following October, and if a portion of the bed was leaves, it is so much the more to be preferred. Having spread the manure upon the surface, it should then be trenched in two spades deep, or about eighteen inches, placing the manure at the bottom of the trench. Level the surface, and spade in an inch or two more of the same kind of manure, and after allowing a week for the bed to settle, it will be ready for planting.

Procuring plants.—The success of planting out depends considerably upon a judicious selection of plants. Suckers of all sizes are generally thrown up, and many cultivators would naturally select the largest: such, however, are not the best; those of medium size, neither too large nor too small, have the finest roots, and spread more rapidly than the others. In selecting, reference should be had to the roots rather than the tops.

Planting out.—Having prepared the beds, and secured a sufficient number of plants, preparations may be made for setting out. A spade, a rake, and a garden hoe will be the proper implements to accomplish this. The bed being marked out, stretch the line across the bed, from east to west, at the distance of two feet from the walk: commence on either side of the line at one end, by taking out the earth the width and depth of the spade; place in the plant against the line, and throw the soil out of the second hole to fill up the first: in this way proceed until the whole bed is planted, treading the soil lightly around each plant; with the rake smooth and level the whole, and the work is finished. The rows should be three feet apart, and the plants three feet apart in the rows.

Winter treatment.—On the approach of cold weather it will be necessary to protect the plants for the winter. The best method of doing this is simply to bend the branches down to the ground, and cover them with four or five inches of the soil. Some cultivators use leaves, and others coarse manure, but we believe nothing answers better than the common soil in which they grow.

Summer treatment.—As soon as danger of cold weather is over, which is generally the first of April, the plants should be uncovered, and a stake placed to each, to which the stems should be securely tied: the first summer very little must be expected from the plantation, and only a few suckers will be thrown up from each plant; but by the second year they will be more numerous, and produce considerable fruit. As soon as the plants are tied up, proceed to level the ground, and give it a neat finish with the rake: the only after culture is to keep down the weeds, and the surface loose, by occasional hoeings.

Autumnal dressings.—Enriching the bed at the time of planting is not sufficient to keep the plants in good condition. The beds should have a dressing of two or three inches of compost every autumn. This should be laid on in October and lightly forked in, bearing in mind that a mixture of bog earth, or leaf soil and manure, is better for the plants than all manure. This will encourage the growth of the roots, and in the spring, the suckers which are thrown up to form the bearing plants of the next season, will be much stronger.

Pruning.—The raspberry can hardly be said to need pruning in the common acceptation of that term. All that is required is to shorten the most vigorous bearing stems, and to cut away the old wood after it has produced its fruit. The second summer after planting, the plants will throw up a quantity of suckers: if numerous and small, four or five of the best should be left their entire length; if large and strong, they should be shortened to four or five feet, and the superfluous ones rooted up, unless wanted to form new plantations.

General remarks.—As the raspberry is a rapid grower, after it once takes hold of the soil, quantities of suckers will spring up, which, in the course of four or five years, will weaken the plants. On this account new plantations should be made every fifth or sixth year, and the soil trenched and renewed by the application of the compost already mentioned.

The raspberry is rarely attacked by insects. We are not aware that we have ever been troubled with any during our cultivation of this fruit, for upward of 15 years. On this account, it requires very little care at the hands of the cultivator. As a market fruit it is particularly worthy of attention, requiring less care than the strawberry, easier picked, and the finer sorts commanding a good price.

The following is a list of the best kinds now cultivated. A few of them are new, and as yet, not very extensively known. The kinds we would recommend for a small collection are the white and red Antwerp, and the Franconia; for larger gardens, all the others may be added, which will afford a great variety, and a succession of fruit. The names, with the exception of the three last, are according to the London Horticultural Society's *catalogue*.

Descriptions of the different varieties.

Red Antwerp.—Of fine size, excellent flavor, and productive; one of the best.

Yellow Antwerp.—Syn. white Antwerp. Similar to the last, except in the color of the berries; a delicious fruit, but does not bear carriage well.

Barnet.—Syn. Cornwall's Prolific. A fine, large, red fruit, productive and excellent, but does not bear carriage well.

Common red.—Syn. Old red. The old kind of the garden. An indifferent bearer, and of inferior quality.

Double bearing.—Syn. Perpetual bearing. Said to be a good and productive kind, having the merit of producing one crop in July, and another in September.

Franconia.—Syn. Seedling Grape. One of the most productive and finest kinds cultivated around Boston. Fruit red, large, and handsome. The origin of this sort is unknown. It was originally received from Vilmorin, of Paris, by S. G. Perkins, esq., of Brookline.

New red Antwerp.—A notice of this will be found at page 256. It promises to be, so far as we have tried it, a very fine variety.

Cretan red.—A fine variety, the fruit large and handsome, rather more tart than the Antwerp, and continues in bearing a long time, which renders it highly valuable.

Besides the above eight sorts, the *new Turkish Turban, Victoria, Brentford, Spring Grove*, and the *Ohio Ever-bearing*, are recommended as very fine kinds. To those who have room, we would advise a trial of them.

SQUIRRELS AND A SIGN OF A HARD WINTER.

From the Buffalo Commercial Advertiser.

The Detroit Advertiser says a squirrel hunt took place near that city last Thursday. The total killed was 3360. Other papers notice like wholesale slaughters. The squirrels seem to abound this fall in unusual profusion all over the country. For some weeks past, the woods in the neighborhood of Fort Erie, across the river, have literally swarmed with them. Within the past week or two, they have crossed the Niagara to this side in immense numbers. The rapidity and width of the river, have proved fatal to many of them, but little armies of them have nevertheless succeeded in gaining our shores, whence they pushed off south. On the Alleghany river, we are told they are so numerous, that it is not deemed worth while to waste powder and shot in killing them. Those wishing a squarrel pie stand on the banks of the stream and knock the little "varmint" on the head with a stick, as they swim across. This apparent general emigration of the squirrels to the south, is held by the Indians, and others knowing in such matters, to betoken a hard winter.

INQUIRY CONCERNING HEMP.

A cultivator of drained swamp land, in Washington county, North Carolina, desires to know whether hemp would be a crop suitable for his situation, as to soil and climate. The land is such as was described in the 11th number of vol. vii. The soil is mostly of vegetable formation or material, rich as land can be, and generally well drained, but still sometimes subject to be injured by too much wet. Any reader of this work who can and will give information on this subject will confer a favor on our correspondent, and perhaps render service to many other persons similarly situated.—Ed. F. R.

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THE FARMERS' REGISTER.

VOL. X. NOVEMBER 30, 1842. No. 11.

EDMUND RUFFIN, EDITOR AND PROPRIETOR.

BUTTER MAKING.

From the Cleveland Daily Herald.

Travelling across the Western Reserve, a year or two since, in company with a gentleman from New York, I was surprised to hear him state that "in the eastern markets *Ohio butter* was a by-word, a term synonymous with *dirty butter.*'

I attempted to defend the character of the production of our dairies, and we compromised matters for the present, by agreeing to rest the decision upon the samples we should meet with on the tables of the public houses in the course of the journey. In the end, I had the mortification to find, in a majority of instances, either an oily, rancid, or a ring streaked and spotted article was set before us, that came within the limits of his description.

This should not be. Butter is one of the staples of northern Ohio, and that which is well made will, in all instances, command a cash price sufficient to compensate the dairyman for the extra labor he bestows upon it.

My wife and myself claim the merit of being adepts, or as political demagogues would say, "*real workies*" in this business, founded on a practical experience of near twenty years.

Our method I will detail; first premising that it is perhaps no better than that pursued by many others, for there is here and there a family that furnishes a prime article, though a large share of that which comes into market is of an opposite character. The publication of our method may induce others to throw more light on the subject. In our hands it is invariably successful, but it is like certain chemical processes, made up of a series of manipulations, the omission of any one of which may derange the whole and endanger the result. Every part must be carefully carried out.

1. *Choice of cows.*—A judicious selection from the common stock, I deem to be equal if not superior to any of the imported. The Devons and Bakewells I have tried, and found them deficient in the quantity of milk they afford. The Durhams I have not tested. The Gore breed was introduced into Portage county some years since, by a gentleman, I think, of the name of Thorndike, from Massachusetts. A few of the descendants and crosses are to be met with in the south part of Trumbull county, and they prove to be the best of milkers. The quantity and quality of the milk surpass that of any other breed in our section of the country.

2. *Change of pastures.*—To insure the production of the largest quantity of butter, a frequent change of pastures is required. A farm should be so fenced that the cows can be changed into a different lot every four or five days.

3. *Salting.*—A constant and full supply of salt should lie before our cows in some secure place. They will eat moderately what they require. If only occasionally furnished, they often take it in quantities so large, as to act medicinally to their injury.

It corrects almost any bad quality of the milk, arising from the eating of aromatic or bitter herbs, and also much of the natural animal odor, that frequently impairs the sweetness of butter.

4. *Water.*—It is perhaps superfluous to add, that without a full and steady supply of this article for his cows, the hopes of the dairyman will never be realized. Driving them once or twice a day to a watering place will not answer the purpose.

A large and deep excavation can be made in the several pasture lots, or between two or three of them, so as to answer the purpose, except in very protracted droughts. It should be so enclosed that cattle can approach it and drink, without running into it.

5. *Driving—kind treatment.*—Many a faithful cow has been seriously impaired by a careless boy driving her furiously to and from the pasture. All harsh treatment of any kind, as scolding, striking, kicking, &c., is also detrimental. I have known many cows rendered worthless from these causes.

The utmost kindness and gentleness of manner must be shown on the part of those who manage our stock. I once dismissed a hired man for striking my cows. Too much cannot be said on this point.

6. *Milking.*—This process should be done systematically at regular periods of the day. Sunrise and sunset are perhaps the best periods; for immediately after the one, and before the other, cows in hot weather feed to the best advantage. They are so much creatures of habit that the milker should be changed as rarely as possible. A stranger is always regarded as an unwelcome visiter by a milch cow.

7. *Cleanliness with the utensils.*—The pans, pails, strainers, bowls, churn, and every implement employed in butter-making, must not only be well washed, but they must be thoroughly scalded with boiling hot water, and be perfectly dried afterwards, either in the sun or before a fire. This must be repeated every time they are used. Merely pouring boiling water upon them when loaded with sour milk or cream, will only serve to scald in the bad flavor, if I may use the expression. Wash them at first, and then scald them thoroughly, if you would have sweet butter.

There are certain filthy practices which slatterns fall into, that should be corrected—such as wetting the cow's teats with milk, and permitting it to drop into the pail—milking in the morning without washing the hands, &c.

8. *Milk-house and buttery.*—In hot weather a good spring-house is necessary for the making of butter. It must be constructed of either brick or stone, and in no instance of wood, as that article never fails, in such a situation, to become mouldy, and impair the flavor of butter. It must be built so that it can be thoroughly ventilated. A window should be placed on the north, east, and west sides, which must be furnished on the outside with wire gauze screens, and on the inside with tight shutters. During the day, the shutters must be closed, and at night must be raised.

A spring may be dispensed with—and it is even

problematical whether it does not, upon the whole, do as much injury by imparting dampness, as it does good by lowering the temperature. A well constructed house without the spring, will answer the purpose. It should be shaded with trees, or arbors of grape-vines. All mouldy and decaying wood-work, boards, boxes, barrels, &c., must be kept out of it—also all foreign substances, as meats, fish and vegetables. The air of my spring-house was ruined for a week or more, merely by placing in it a few mackerel.

At the approach of autumn, a cool and well ventilated buttery, shaded well without and kept clear of all foreign substances that can impart a bad flavor, is preferable to a spring house, as the latter becomes too damp, at that season, to allow the cream to form well.

9. *Straining the milk.*—This should be attended to without delay after milking. The new fashioned tin strainer (a tin pail with a wire gauze strainer) is far preferable to the old fashioned cloth strainer. Either tin pans or stone crocks may be used for holding the milk; I know of no preference, except the tin work is liable to rust in a damp spring house. Earthen crocks should never be used, as the lead in glazing may act chemically with the cream or butter, so as to poison it.

10. *Skimming the milk.*—In hot weather the milk may be allowed to curdle before this operation is performed, but if it be delayed any longer, a thin, watery fluid will form between the milk and the cream, after which the good qualities are inevitably destroyed. It is necessary, in midsummer, to skim the milk every morning and night. This point must receive the strictest attention. Neglect of it often gives a streaked or mottled appearance to butter, as well as impairs its flavor.

11. *Cream.*—As soon as it is collected it should be placed in a stone crock, which should be either hung into a well, or set up to the brim in the spring within the milk house.

It has been thought by some that the cream improves, or matures, by exposure to the air after it is collected, and that placing it in a situation as cool as a well, or spring, is unfavorable for that change. This view may be correct late in autumn, when it becomes sometimes necessary to mature it by artificial heat, but during our hot and dry summers, we believe the course recommended is to be preferred.

12. *Churning.*—This operation must be resorted to as soon as a supply of cream is obtained, and in hot weather cannot safely be delayed beyond the third day.

A variety of patent churns have been palmed upon the public, none of which, we believe, is to be preferred to the old fashioned, upright dasher, or the barrel. We at present employ the former, and by the aid of a well adjusted spring pole, connected with the top of the dasher-rod, can fetch twelve or fifteen pounds of butter, in from fifteen to twenty-five minutes, without any violent efforts.

The barrel churn is not as easily cleansed.

13. *Working of butter.*—This must be repeated until every drop of the buttermilk is expelled; twice or three times will be necessary, nor must it be delayed too long, till a change begins to take place in the remaining buttermilk, as that will impair the flavor of the butter, which no subsequent treatment can restore.

The operation must be done in a bowl, by the aid of a wooden spatula, or paddle, and in no instance should the hand come in contact with the butter, if it can be avoided, as the warmth of the individual renders the butter oily and bad-flavored.

Some persons destroy its sweetness and richness by washing out the buttermilk by means of cold water, a practice always to be avoided.

14. *Salting.* The salt should be added at the commencement of the first working. Much of our western butter is injured by the employment of the common New York salt. The finest *ground* article should be used. It can now be obtained in sacks, of our merchants, at a reasonable price.

15. *Preserving butter.*—That made in the spring and summer may be laid down in *stone* crocks, and the surface covered with brine of strength sufficient to bear up an egg. In winter this will answer all the purposes of cookery, and even for table will be sweeter than much that finds it way there. J. P. KIRTLAND.

Rockport, Oct. 14, 1842.

A CHEAP UNDER DRAIN.

For the Farmers' Register.

Below is the plan of a blind ditch, claiming notice on the ground of cheapness. By keeping a strict eye to economy, expedition and durability at the same time, this plan has suggested itself to me as approaching nearer the means of the small farmers than any I have seen proposed, practicable by those with lands and pockets similar to mine; for a too common objection to the many plans projected for this purpose is, that they drain the pocket rather more sensibly than the land. The plan here recommended, to say the least of it, is one not costly, either of money or time, and one from the cost of which no one will be deterred from a trial.

In my corn-field of last year, 1841, there was a piece of ground, about two acres, rendered almost totally worthless by the superabundant moisture in the surface soil, in consequence of the hard and impenetrable nature of the subsoil. In a subsequent arrangement of my crops, this spot was thrown into the shift for corn again for the present year. Having determined last winter, from last year's experience, not to cultivate it again in its then condition, I accordingly set about draining it on a cheap plan. The land being stiff and hard enough to support a ditch of any form, and situated rather flat, I commenced a ditch at a distance off, down a gentle slope, sufficient, by maintaining a level along the bottom, to gain the depth of two and a half feet when reaching the place designed to be drained. From this ditch, brought up to the edge of the flat, I ran off several branches in different directions, aiming each arm along the wettest places, maintaining the same depth, and no wider than the width of an ordinary weeding hoe, with which tool and a grubbing hoe the whole work was performed, with the exception of a spade to scrape and level the bottom. After allowing this to remain open for several days, and the surface had become freed from standing water, I gathered up and laid in the longest, straightest, and stoutest corn-stalks most convenient to the

spot, to the depth of about one-third of the ditch, dropping them one in a place, so as not to have too many ends immediately together, which would leave cavities for the admission of the dirt. I then put on a coat of clean pine tags, sufficiently close and thick to prevent the dirt from reaching the stalks on the bottom, slightly packing them, and then drew in the dirt, which has a depth, from the tags to the surface, sufficient for common tillh. To finish it, I raised it a little, allowing for its sinking, and for the purpose of preventing its being washed by heavy fall's of water.

The plan of this drain may be objected to by some, on the score of durability. This certainly is questionable ; but as to economy and expedition none can object, as the whole of the work may be done by any hand capable of using a hoe and a spade, as all field hands are, without the services of either ditcher, sawyer or carpenter. Corn-stalks and pine-tags, I know, are very destructible when exposed to the influence of the atmospherical air, but being placed at the depth here required, almost totally excludes this agent of decomposition, and I am inclined to think their duration would far exceed the expectation of many. I once observed, in a recently broken mill-dam of long standing, green pine brush that seemed to have been thrown in for some purpose during the construction, and buried there for a time, beyond recollection, perhaps for ages, that had so far retained their original state, that even the color of the leaves was but slightly changed.

There is a path across the lower and main drain of this ditch, over which loaded carts and teams frequently pass ; yet whenever the flat above is the least wet, there is always a stream of water proportioned to its wetness issuing from its mouth. The corn now standing on the piece of ground drained by this ditch, notwithstanding its being in corn last year, and the unprecedented wet season this, will multiply at least four or five times the product of the preceding crop.

TH. N. DELK.

Surry C. H., Nov. 8th, 1842.

ARTESIAN WELLS IN ALABAMA.

To the Editor of the Farmers' Register.

Greensboro, Ala., Oct. 28, 1842.

I have been intending for some time to endeavor to atone for my remissness in other respects by giving you some account of the Artesian wells which have been and are being bored in this part of the country, as being a subject of great intrinsic interest to one of the wealthiest regions of the south-west, and indeed to all prairie countries, which labor under the great inconvenience of a scarcity of water.

As you are no doubt aware, the prairies reach nearly across the states of Alabama and Mississippi, in a direction a little north of west in this state, and in a belt of some 30 or 40 miles, lying principally between latitudes 32 and 33° north. They are composed of a black calcareous clay, in which the carbonate of lime is found in considerable excess—in some instances as high as 60 per cent. The larger proportion of this description of soil is covered by a dense forest of oak, ash, hickory, elm, cotton wood, and, in quite a considerable portion, there are large forests of cedar, which no doubt vie in size and beauty with the far famed "cedars of Lebanon." Some of them square 2 feet at the but, and are of great height. The most of this black-land country, particularly where the oak and ash prevail, was originally covered with dense cane, and hence the whole of it is usually denominated the "canebrake," though very few vestiges of cane are still remaining. The general surface of the country is undulating, and the rotten limestone rock, which invariably forms the substratum to the soil, sometimes approaches within a few inches of the top, and is frequently entirely denuded by the washing rains, which constitute the greatest obstacle to keeping them in a permanently improving state.

The great fertility of the soil, the propitious latitude for the cultivation of cotton, and the facilities or navigation afforded by the numerous rivers issuing from the great spur of the Cumberland mountains above, all contributed to bring this belt of country into very early notice : but the difficulty of procuring water presented an insurmountable obstacle in the eyes of the first settlers, and as the soil is excessively wet and disagreeable in the rainy months of winter, very few of those who had much regard to comfort were at first induced to settle upon it. When the more wealthy class of planters, however, began to come in, the allurements of gain were too tempting to be resisted, and they combated the inconvenience of the want of a permanent supply of water, as they best could, by cisterns, seep-wells, and such other contrivances as suggested themselves to different individuals. So great a desideratum, however, as water was not long to be endured ; and the idea of boring Artesian wells entirely through the rock was, I believe, first successfully carried into practice by a man named Cooper, a native of Connecticut, who possessed considerable mechanical genius, and that particular turn of mind which is always on the "*qui vive*" for something new and striking. Not that the idea itself was really a new one, for Dr. Darwin, in his Phytologia, (Dublin, octavo, 1800, p. 239,) notices several instances of water rising much above the surface, and says, "the knowledge of this part of geology, concerning the formation of springs, may be employed for many useful purposes," &c. Thus where water, descending in high columns between the strata of mountains, is dammed up below by the materials which fill up the valleys, if a hill be bored in the valley deeper than the incumbent strata, it frequently rises much above the source of the new aperture, and sometimes above the surface of the ground. In sinking the King's well at Sheerness, the water rose 300 feet above its source in the well, as related in "Philosophical Transactions," vol. 74. Again he says, "In the town of Richmond, in Surrey, and at Islip, near Preston, in Lancashire, I am informed that it is usual to bore for water to a certain depth ; and that, when it is found, in both those places it rises so high as to *flow over the surface.* And, there is reason to conclude, that if similar experiments were made in many other places, such artificial springs might be produced at small expense, both for the common purposes of life, and for the great improvement of lands by watering them." He goes on to give many reasons for entertaining these opi-

nions, founded upon his knowledge of the strata of the earth, and states that, in "Hartford, Connecticut, there is a well which was dug 70 feet before water was found, and then, in boring an auger hole through a rock, the water rose so fast as to make it difficult to keep it dry by pumps till the hole could be blown larger by gunpowder, which was no sooner accomplished than it filled and ran over, and has been a brook for near a century." (Travels through Amer.: Lond. 1789.)

Whether the doctor was correctly informed as to this running-well in Hartford, I have my doubts; for, though I have visited the place, I never heard of it, nor have I ever been able to learn any thing about it from any person from there. As Hartford, however, is near Wadsworth's mountain, on the top of which is a very deep lake, it is very possible that some vein leading from it may have been struck, which caused it to flow over.

But to proceed with the matter before us. The prairies in this county extend up as high as Erie and Greensborough, on the east side of the Warrior river; and about half way between the two places is the largest; at the head of which is my summer residence. When I first came to this part of the country, settlers were deterred from going lower down into the prairies on account of the scarcity of water. In the course of the last year or two, however, that has become the finest watered portion of the country, by means of Artesian wells. Indeed every planter has it now in his power to have as much water as he wants, and in whatever place he wants it; if it is on the top of the highest hill on his plantation. Well-boring has become a trade, and contracts are almost universally made, "no water, no pay." For the first 4 or 5 miles from the head of the prairies it is usually obtained in great abundance by boring about 300 feet. In this distance they generally go through 3 or 4 strata of rock, and just before reaching water, the rock becomes so hard that a cast-steel pick has to be substituted for the auger with which the rotten limestone rock is bored. The hole perforated is generally about 3 inches in diameter and the auger is worked by pine poles connected together by a head and socket, which are successively added until the object is attained. To obviate the difficulty of drawing up the poles caused by the suction and pressure of the atmosphere, a small aperture is left near the centre of the auger, by which the air can get below it. The quantity of water sometimes thrown up from one of these auger holes is almost incredible, and shows the great pressure to which it must be subjected beneath the stratum perforated. I have seen one which throws up 50 gallons per minute, 5 or 6 feet above the surface, and it will run over the top of a tube 25 feet above the surface, though in a very diminished quantity. There are several others in the immediate vicinity nearly as bold, and in a few instances the water has forced its way out through the natural crevices in the rock, and runs all the year, though in comparatively very diminished quantities. The auger used is about 20 feet long, with a shank 1 inch in diameter, through which a half inch hole is bored to admit the air.

The number of Artesian wells in Greene and Marengo counties is probably nearly 500. The great quantity of water they throw out is supposed to have made the canebrake much more unhealthy than it formerly was, as it stagnates in the deep holes and ravines, which otherwise are generally dry before the sickly season. The dip of the bottom stratum of rock, beneath which the water is generally procured, averages about 20 feet to the mile, in going from north to south across the prairies, though there is no great uniformity in it, water being found in the same vicinity at very different depths. In Demopolis there is a running well 500 feet deep, and very near it there is one bored 600 feet without getting water. These are about the customary depths on the south side of Big Prairie creek, though on Cottonwood creek, one of its southern tributaries, the borings have been carried upwards of 900 feet in some instances without getting through the rock. To whatever depth, however, the rock is perforated, it is found to contain the same fossils, consisting mostly of scollop, cockle and oyster shells, though not of the same species we now find in Mobile. I have been shown some very perfect specimens lately which were bored up 540 and 570 feet below the surface. Pyrites or sulphuret of iron is also frequently bored out from a great depth, and as the little balls, called sulphur balls, in which it is found, are very hard, they frequently interfere very much with the boring.

The water procured from those wells is always impregnated pretty strongly with sulphur, and from the deep ones appears quite warm in winter. Persons accustomed to it, prefer it to any other, though it is unpalatable to those who are not. Stock of all kinds are very fond of it, and a cow will swim a creek in winter to get to it. From the few hasty and desultory hints I have been able, "currente calamo," to throw together, you will perceive that this is a very interesting portion of our country, both to the geologist and scientific agriculturist. The great susceptibility of improvement our calcareous soils possess, will at some future day render them extremely valuable; as instead of being exhausted, they improve by cultivation. Should I be able to steal an hour from the more pressing engagements of business, I purpose before long to give you some of the results of my observations and experience in the cultivation of prairie soils. At present my paper and time are both at the "Ultima Thule."

Yours, very respectfully,

ROBERT W. WITHERS.

FATAL EFFECTS OF CASTOR OIL ON A HORSE.

From the Tennessee State Agriculturist.

A case has recently occurred in England, in which the death of a horse was evidently produced by the effects of a quart of castor oil given as a purgative. It operated powerfully; but the animal soon died. On examination, a large intro-susception of the jejunum was discovered, and the mucous membrane of the stomach and intestines exhibited marks of severe inflammation."

I lately met with the above in an old number of a medical journal, which brought to mind too cases that fell under my observation at Lexington, in Kentucky, in which the death of two valuable

horses was supposed to have resulted from the same article, administered to them in about the same dose as a purgative. Symptoms of violent intestinal irritation ensued, and after a few days the animals died apparently exhausted by the powerful purging. I should give castor oil to a horse with great reluctance, and never if I could procure any other purgative. It is a pity that so little attention is bestowed upon the disorders of this invaluable animal by men of sense and intelligence, and that they are so generally turned over, when they fall sick, to the tender mercies of the ignorant but most conceited horse leech.

Rutherford Co., Sept. 1842. L. P. Y.

A MILLION OF DOLLARS LOST ANNUALLY IN MASSACHUSETTS.

From the Boston Cultivator.

Have you any place adopted, to save all the liquid excrements of your stock, for the ensuing winter? If not, the loss you must sustain will be fully equal to the whole value of their solid excrements.

If you have not a barn cellar, as every good farmer should have, as soon as he is able to make one, you have no excuse for deliberately subjecting yourself to this great loss. You can dig out the loam under your stables, it will be very valuable as a top dressing on your mowing lands, and then fill up the hole with muck or loam to absorb all the liquid excrements.

We have no doubt that the loss of liquid manures in this state, amounts to a million of dollars annually—we know from them a compost can be made equal in bulk and value to the solid manures. Our own practice, and the results of the most accurate experiments by others, leave not a doubt in our mind on this subject. Will you make the experiment for yourself?

Whenever you discover rigid economy about the manure heap, you will always find a corresponding improvement in the soils and crops.

He who starves his swine, must eat lean pork, and he who starves his crops may expect to go without bread.

WORMS IN THE HEADS OF SHEEP.

From the Boston Cultivator.

Worms in the heads of sheep result from a fly depositing its eggs, during the summer months, in the animal's nostrils.

The sheep knows this fly, and as soon as she hears it, she starts off, rubbing her nose on the ground for rods at a time, till she feels that the danger is past.

Mr. Colt, of Pittsfield, remarked to us, that during fly time, sheep would retire to the shade as soon as the dew was off, huddle close together, then by stamping and keeping their heads close to the ground, they could defend themselves from this troublesome and *often very fatal enemy.*

Having thus observed the habits of the sheep—he never salts them after the dew is off, for calling them out for this purpose would expose them to the attacks of the fly. He observed that his sheep crowded together where they could stir up the dust. He inferred from this, that the dust adhered to the nostrils and operated to protect them from the attack of the fly. So he ploughs spots, where his sheep congregate, that they may have the benefit of the loose earth.

Who has not seen the sheep sally out from the shade and crowd to feed, and before she has proceeded five rods, run suddenly back again, ploughing the earth as it were with her nose? She heard, or was attacked by the fly. Thus it is easy to tell when this dangerous enemy to the favorites of *Pan* is in the field and the flock requires your peculiar care and attention.

EXPERIMENT OF JOHN J. MARSHALL WITH BROAD-CAST CORN.—1842.

From the Farmers' Gazette.

The land selected was about five-eighths of an acre on the river bank just above the month of Whortleberry creek. It had been planted in corn for several years and badly cultivated, so that it was very foul, and was manured.

It was broken up for the first time on the 17th May with a two horse plough. There being a heavy coat of grass and weeds in it, the latter as high as a tall horse, it was cross ploughed with a single horse turning plough on the 30 h May. The corn was sowed on the 18th of June, at the rate of very near four bushels of our common seed corn to the acre, and covered with a small turning plough very shallow. Each ploughing and the planting was after a rain. The corn came up in a few days and grew off rapidly.

When about a month old, (21st July,) being from 5 to 6 feet high on the richest part of the land, it began to budge just as very rank oats sometimes do, and in a few weeks nearly all the best of the patch was very much fallen and tangled. It continued green and growing, however, except that immediately on the ground, which rotted.

The fodder having begun to ripen, the corn was cut on the 19th September, with grass blades and weeding hoes. Two spots were selected which I deemed to be a fair average of the whole patch, each 9 feet square, in one the stalks weighed 55lb. and in the other 100lb. being an average of 82½lb. to 9 square yards, and at the rate of 44.367lb. to the acre. I selected a spot 3 feet square on which the corn had not fallen down though it did not stand as thick as the land would have borne it, in which the stalks weighed 27lb., being at the rate of 130.580lb. to the acre, estimating an acre to contain 4840 square yards.

The day on which the corn was cut proving cloudy, it was left on the ground till the middle of the next day, when it was put up like a top stack, the layer of stalks about 18 inches thick, and both ends left open. It has cured very nicely.

There are no ears of corn except a few small and immature ones. John J. Marshall.

October 14th, 1842.

ANOTHER FLOATING ISLAND.

The New York State Mechanic, after giving some account of the floating island in Derwent Lake, near Keswick, in England, matches it with one in Clinton, in the north-eastern corner of New York. We copy what relates to it.

"Remarkable as this floating island may be, it is sarcely more so than one of a similar description in Clinton county, in this state. Several years since, Rev. J. W. B. Wood, a gentleman of an inquiring turn of mind, and then residing not many miles distant, made a visit to the spot, and his account was published in the Christian Advocate and Journal, of New York city.

"The lake in which the island is found lies in a deep gorge or rotten gulf of high table mountains, equally noted through the surrounding country for its "huckleberries" and its rattlesnakes, and called the Flat Rock. The water of this lake is very deep, and the island differs from the one above described in constantly floating. In fact, a number of pines were growing on it at the time of the visit of Mr. Wood, some of which were five or six inches in diameter. The surface is covered with the productions peculiar to marshy grounds, and though the soil is so soft that a sharpened pole may be thrust completely through, yet stray cattle have been discovered on it at various times. Strictly speaking, it is not an island, but a peninsula, and this will explain the apparent inconsistency contained in the last sentence. However, that the peninsula, or island, (whatever the reader may please to term it,) floats, and is disconnected from the bottom, is demonstrated from the fact, that the wind will cause it to change its position, varying some days many rods from the preceding. Were the isthmus, that acts as an anchor, severed, it would undoubtedly float on, with trees for sails, a complete floating island."

SUCCESSFUL MANUFACTURE OF CORN-STALK MOLASSES.

From the Philadelphia Public Ledger.

Mr. James L. Vaughan, of Henry county, Tennessee, has succeeded in manufacturing excellent and clear molasses from corn-stalks. A letter in the Nashville Banner in relation to it, says: "It is pronounced by all who have tasted it far preferable to that made from the sugar-cane. It has somewhat the appearance of honey, and the more you use it, the better you like it. The mill for grinding the stalks is very simple, costs only six dollars, and can be made by any common mechanic who has ever once seen it. With this mill, which would answer very well for an apple mill, and which runs with two horses, he produced one hundred and twenty gallons of juice per day. The yield of molasses from the juice as it came from the mill was as one to five. If planted early, and cut in August or September, Mr. Vaughan thinks about sixty gallons of molasses from each acre in corn might be obtained, and perhaps more. The corn which he used was planted very late in June, and a severe frost fell before he finished cutting it. To this frost, and to the fact that the corn had not sufficient time to mature properly, he attributes his failure in making sugar. Mr. Isaac Norman, the mechanic who constructed the mill, and who had been an old sugar planter in Georgia, says that he never saw finer syrup from the sugar cane, or which gave greater appearances of graining, and that it did not grain must be altogether owing to the frost, which fell the day before they commenced operations. Mr. Vaughan is, however, highly pleased with the success of his experiment so far, having demonstrated conclusively, that with a mill not costing more than six dollars, every farmer in Tennessee can manufacture his own molasses, and that of a superior quality. Another year, he hopes to add his sugar also. It must be mentioned that the 'refuse juice,' which is skimmed off in the act of boiling, makes a most excellent beer, and can likewise be made into excellent vinegar."

TIME OF RIPENING OF WHEAT ON SOUTH SIDE OF JAMES RIVER, 10 MILES BELOW CITY POINT.

For the Farmer's Register.

1818. Began harvest on June 25 h.
1819. Began harvest on June 23d.

1822	"	"	"	8th.
1823	"	"	"	13th.
1824	"	"	"	11th.
1825	"	"	"	10th.
1826	"	"	"	12th.
1827	"	"	"	16th.
1828	"	"	"	12th.
1829	"	"	"	19th.
1831	"	"	"	16th.
1837	"	"	"	16th.
1839	"	"	"	13th.
1840	"	"	"	8th.
1841	"	"	"	21st.
1842	"	"	"	13th.

The variety of wheat principally sown was in the earlier years the bearded golden chaff, and in the later, the mountain purple straw. Since, about the year 1822, cutting was generally begun as soon as the wheat was well in the dough state. Prior to that time, never until the grain was nearly hard. In 1826 and 1829, harvest might have been commenced three days sooner, but for the pressure of other work on the farm. In 1841 we had a very cold, wet and backward spring, which no doubt postponed the ripening of wheat several days.

I regret exceedingly my inability to give the above list without interruption or omission.

E. RUFFIN, JR.

EXTRACTS FROM ENGLISH CORRESPONDENCE OF ALBANY CULTIVATOR.

I learn from Mr. Hebeler, his Prussian majesty's consul general, that Count Howpesch, a Belgian gentleman, has taken out a patent for the preparation of a manure, more powerful and cheaper than any yet invented. His plan is said to consist in fixing all the volatile parts of night

soil and other such substances, by means of the ashes of the volitic shale of Portland. The shale is employed in the first place as a source from which oil, turpentine, and other substances are extracted; the residue goes to the preparation of the manure, which is said to be converted some where on the Isle of Dogs, and sold in a dry state in the form of bricks. As the materials to be thus employed are inexhaustible, and at present almost valueless, it is expected that the preparation of the fertilizer in question will become a matter of great national importance. As people have become too wise to wonder at sugar being made from old rags, so will they be equally prepared to hear, that oil, and tallow and soap, are to be fabricated from the hardened mud of the coal mines; for such is "shale."

Nearly four thousand pounds have been already subscribed for the monument to the memory of the late Thos. Wm. Coke, Earl of Leicester. Prominent amongst the subscribers, is Lord Wodehouse, the Lord Lieut. of Norfolk, for £50, who had all through life been opposed to the deceased peer in politics. This is as it should be; when the interests of our country and the improvements of agriculture are to be served, all party and party jealousies should be thrown overboard. In the spread of improvement among the cultivators of the soil, all are more or less interested, and should combine therefore, for the general welfare.

ANOTHER "AMENDE HONORABLE." RENEWAL OF THE ROTATION DISCUSSION.

[It would be ungracious, and appear unkind, if we were to refuse admission to the following communication, understanding as we do, and confiding in the perfectly conciliatory and kind feelings which influence the writer. But, notwithstanding, we must confess that, like Falstaff, we are "still afraid of this gunpowder Percy, [i. e. the rotation controversy,] although he may seem dead;" and rather dread that our correspondent's designed peace-making explanations may tend to a like result, as in the noted case of the reconciliation of Sir Peter and Lady Teazle.

With the best wishes and great respect for both the late parties to this discussion, we shall leave them (and all others disposed to engage in it) to the care of our successor in editorial duties and responsibility.—Ed. F. R.]

For the Farmers' Register.

I did exceedingly regret that the controversy in which I was engaged with Mr. Peyton had become so personally offensive that it was necessary to arrest it. The subject in dispute I then considered, and still consider, as very important, and therefore wished to conduct it to a definite issue. In my first piece—that commented on by Mr. Peyton—I merely stated the result of my own observations and reflections, and this I did without the slighest attack upon any man, or upon any man's theory. A reply, however, soon appeared; and this reply (pardon me for saying so) presented, in several of its points, so strong a temptation to ridicule, that I had not the firmness to resist it. But if Mr. Peyton had been *acquainted* with me, I should have been spared the trouble of telling him, as I now do, in all candor, that I intended nothing disrespectful, or in the slightest degree personally offensive. All that I aimed at was a little playfulness, in which, perhaps, I am too prone to indulge, even in the serious matters of a personal controversy. I hope the above will be satisfactory to Mr. Peyton, to the respected editor, and to the readers of my favorite Farmers' Register.

If I had occasion to regret that the discussion was broken off, I am now as much pleased that every obstacle to its renewal is so happily removed. The "amende honorable," which appeared in the last Register, is entirely satisfactory to me, and, I presume, to all parties. Which of us has sinned most, I also cheerfully leave to a candid public as the umpire. But even if the balance sheet shows the greatest amount against my opponent, justice requires me to say, that he has, most amply and handsomely atoned for the whole. I only regret, that my plain and rustic habits have become so confirmed, that I should only bring upon myself ridicule, were I to attempt an apology in the polite style, which seems so familiar to him. But if I fail in matters of etiquette, I must remind him of the expressive adage—"to sin is human—to forgive, divine."

With these remarks, I do respectfully propose a renewal of the discussion: and this I do, not in the spirit of banter or vaunting, but simply that we may elicit the truth on this interesting subject. If I am wrong, I can truly say, that I wish to know it, and, if *convinced*, I pledge myself to avow it. As, however, I still regard myself as the challenged party, I must adhere to the privilege of dictating the terms on which the contest is to be conducted. I propose therefore that all that has been already settled, that relating to the "beans," to the Göttingen farmer's crop of wormwood, to old tobacco lots, &c. be all left out of view. And this I propose, not because I am unwilling to meet them again, but simply because they have been already so fully and fairly met, that a renewed agitation of them would be regarded as a useless and offensive repetition. And that the whole subject may at once come before us, I will here state that I wish the discussion to be confined to a *fertile* soil. In *such* a soil, then, I would respectfully ask—

1st. What special benefits are expected to result from varying the crops?

2d. Are these benefits to the soil, or to the crops, or to both? And

Lastly—How do these benefits manifest themselves in either case?

I will merely add, that since the commencement of this discussion, my attention has been more than usually awake to every thing that had a bearing upon this subject. I have therefore felt myself greatly strengthened in my previous opinions, by two articles which have come under my notice. The first is from the pen of an interesting writer, who subscribes himself "William Partridge." Now, who this Mr. Partridge is, I candidly confess, I know not. But I have fre-

quently seen his writings, especially in the Cultivator; and from these, it is evident that he is a scholar of no ordinary rank. Mr. Partridge, then, (See Cultivator, number for October, 1842, page 159,) expresses himself in the following forcible manner: "It is but a short time since chemistry has been applied, practically, to agriculture, yet every day developes something new. I think it will ere long be found, that instead of a succession of crops, the raising of one product on the same land, *in perpetuo*, will be found far more beneficial. To do this, it will only be necessary to apply to the soil those materials which every plant requires for its constituent principles, and these may be developed by a correct analyzer." This is the opinion of one of our best writers on chemical agriculture, and with him I do most cordially agree. I have also seen the same sentiment expressed in a different form, by some other eminent writer, but who it is I cannot at present call to mind. But the sentiment is this:—that the best manure for any plant is that which is furnished by itself. Thus wheat straw is the very best manure for growing wheat, and corn stalks for growing corn, and the prunings of the vine for the growing vine. It is certain that nature makes use of this very kind of manure, and of this alone, for sustaining her crops. The gigantic oak, which sends forth its boughs till they pierce the sky, is nourished by the leaves which fall from itself. In fact, I see not how the advocate for some peculiar ingredients in the soil can sustain himself on any other principle.

But perhaps it may be said, that this is merely the theory of some *book farmer* and scholar, and that it wants the force of the man of practice. Happily for me, I have also such an example at hand. Mr. Weaver, of Rockbridge county, (see Farmers' Register, number for September last, page 412,) is represented by some spirited writer signing himself "Ploughboy," as one of the very best farmers in that flourishing section o country. Actual results are detailed by this writer, which incontestably show that Mr. Weaver, in the great and essential points of improving his lands, and at the same time deriving from them large and constantly increasing returns, is one of our very best practical farmers. This writer says, "Mr. Weaver does not object to taking several crops of corn or wheat from the same land, *provided it is rich.*" This quotation, taken in connection with the former one, embodies in a remarkable degree my whole theory on the subject of rotations. If the soil be only *fertile*, I have only to open my eyes, to see that corn will succeed corn, and wheat will succeed wheat; and the same may be said of most other crops. If the second crops be inferior to the first, or the third be inferior to the second, I can very readily account for it, from the fact that there has been a proportioned diminution of the fertility of the soil. Wherever the fertility remains the same, as is the case on rich alluvion, or where the fertility has been increased by applications of enriching manures, the succeeding crops, as faithful tests, will show the fact. When, therefore, I see a crop fail, I do not ascribe it to a demand for a rotation, but to a demand for increased fertility. Nor in this can I be mistaken; for an application of manure *never fails to cure the evil.*

But I am anticipating my subject. I merely throw out these hints to pave the way for a discussion, if Mr. Peyton thinks proper to accede to my propasal. J. H. TURNER.

"BOKHARA CLOVER."—SOILING.

From the Albany Cultivator.

We have a letter from Jas. Gowen, esq., of Mount Airy, near Philadelphia, in relation to an article in our last, headed "Another humbug exploded," from which we copy the following:

With its public introduction I know only this, that early in the summer of 1841, Mr. Buist, a practical horticulturist of Philadelphia, sent to a meeting of "The Philadelphia Society for promoting Agriculture," a few plants, which he called "Bokhara clover;" on sight of which, I pronounced it to be identical with what I had a small patch of in my garden, by the name of "sweet scented, flowering clover," the seed of which I received from a friend who had procured it in New-York. On my return from the meeting to Mount Airy, I compared one of the plants exhibited with those growing in the garden, and found them precisely the same. This neither increased nor diminished my zeal for the increase of the so called "Bokhara" or "sweet scented clover." Already I had what might be called a clever patch, considering the few seeds I began with, and was determined to persevere till I could seed an acre, so as to be able to feed it in such quantity as would put its merits fairly to the test. The seeds were given to me as those of a flowering plant of exquisite perfume, and in view of this character they were sown; but when grown, its leaves so resembled the lucerne, and its taste so highly clover favored, I thought its proper place was the field rather than the garden: to which it shall be transferred next spring, to be made up in fresh boquets for Dairy Maid and her companions, who, though they may indulge in a toss of their heads, will never, I'll warrant, turn up their noses at them.

Soiling, through the summer, is a favorite practice with me—I might add, a necessary one. My farm, about 100 acres, is of light soil, on one of the highest ridges in the highlands of the county of Philadelphia. To turn out some 30 to 40 head of cattle to pasture in the summer on these uplands, under our burning suns, would be to consume all the grass in these months, leaving none for hay—to keep the fields bare to summer's heat and winter's cold—thereby injuring the soil and diminishing the supply of grass for the next season, to say nothing of the comfort of the cattle under such exposure, gathering up a withered herbage from a scorched surface. These evils, I obviate by soiling—keeping my cattle comfortable and in good condition upon some 4 acres of land under lucerne, rye, and red clover; allowing me to save more than one hundred tons of good hay, and affording the best heap of manure from stable alone since May last, from the same number of cattle, that can be met with any where. But I did not set out to write a chapter on soiling; the noticing it at all was merely incidental to showing how natural it is for me to take an interest in every thing likely to increase my means in carrying out the practice—and there is no grass or plant I

have yet seen, that affords to me such promise as the "sweet scented" or "Bokara clover," which, should it come up to my expectations, shall be made public for the benefit of agriculturists. If I be disappointed, I shall have no cause to complain, as I can console myself with having deserved success, and that the failure involved only a small share of attention to a few grains of seed presented to me by a friend, and that I never encouraged any one to lose time or money on its culture. But if it prove to be as valuable as I expect, it will matter but little whether the plant is indigenous or exotic—whether it luxuriates on the fertile plains of Bokhara, or in the cultivated gardens of New-York.

NEW METHOD OF GRAFTING APPLE TREES.

From the Connecticut Farmers' Gazette.

Plant the seed in rows at a suitable distance from each other, and the hills say about five feet apart in each row. But one tree should be suffered to grow in a place. Now when the young tree is sufficiently grown, in the spring of the second or third year, any quality of fruit may be grafted into it in the following manner: First, bend the tree over and obtain for it a firm resting place, either on a block or a board resting on the knee, (after it has been divested of its branches) and with a stout sharp-pointed knife, pierce holes directly through the centre of the tree, about five inches apart, into which the scions are to be introduced—leaving above, two or three buds. A trench is then to be dug, in a direct line between the trees, about four inches deep, and the whole tree bent down and buried, leaving the tops of the scions above ground. In this new condition, the scions become uniformly thrifty young trees, supported and nourished from the buried tree, from which issue, in due time, roots from its entire length. The second year from this operation, the whole parent tree may be dug up, the new growth sawed apart, and transplanted. It will thus be seen that if the tree is five feet in height, ten or twelve young trees, of whatever quality is chosen, may be obtained in this way, whereas by the ordinary method of grafting, there could be but one, provided the graft lived. The young scion will bear fruit, thus transplanted, in the same time it would had it been grafted into a tree fifteen years old.

I know not whether this process is new among your agricultural community at the north; but I have repeatedly witnessed it in Georgia and Alabama, and I have been informed by some of the best horticulturists in those states, that it is always successful. Yours, respectfully,

HENRY LEE.

The foregoing communication of Dr. Lee, deserves the attention of every farmer and gardener. —*Ed. Far. Gaz.*

TO KILL WEEDS.

From Loudon's Gardeners' Chronicle.

Is there any manure that will kill *weeds?* is a question not unfrequently put. Will nitrate of soda, or nitrate of ammonia, or guano, or urates? That such questions should be asked proves one thing at least, that there is a general desire to know how to extirpate weeds. We wish we could add that they also indicate some acquaintance with the rudiments at least of vegetable physiology.

Weeds, like other plants, have each their peculiar constitution, prefer certain kinds of food, and perish on the application of others. We have seen a pound of nitrate of soda administered to a sea-kale plant without visible effect; half an ounce would probably destroy a rhododendron. Common stable manure is prejudicial to coniferous plants, and in over-doses will kill them; an oak feeds greedily upon it. So it is with weeds. Excessive doses of salt will destroy all ordinary vegetation, weeds included, but promote the growth of asparagus in a most remarkable degree, thus proving itself to be a poison to one plant and a nutritious food to another. But salt cannot be used in large doses to extirpate weeds generally, because some, like the asparagus, may flourish under its action, and most crops will certainly be destroyed by it. Professor Henslow succeeded in destroying moss and weeds on gravel walks, by means of corrosive sublimate, green vitriol, and blue vitriol, especially the last. But corrosive sublimate destroys every living form of vegetation, as well as the weeds; and the two sorts of vitriol have no permanent action, encouraging the subsequent growth of many sorts of plants, and so promoting the vegetation of weeds rather than destroying it.

In practice, these chemical agents can only be employed for the destruction of weeds in certain special cases, such as the asparagus, which thrives under doses of salt, which kill most other plants; or as tobacco, which feeds greedily upon quantities of nitrate of soda, which would destroy any ordinary vegetation. In general, we must look to other means for ridding ourselves of troublesome weeds, and we shall find those means in *industry* and *common sense*. The two separate are good things, but they are better mixed together. The plain and obvious rule is to pull weeds up as fast as they appear, and while still in the state of seedlings. Then every plant that is removed is effectually destroyed, and leaves no young ones behind it. Any boy, at half-a-crown a week, can be taught to distinguish them; and if the plan is persevered in, there will very soon be nothing for the boy to do. Strict attention must, however, be paid to their thorough extirpation when young; it will not do to pull up *almost* all, and to leave the remainder to seed; for in that case the labor has to be all gone over again.

FENCES.

[Our views, in opposition to the dishonest principle and baneful operation of the law of enclosures in Virginia, have been presented to the public so often and so fruitlessly, some years ago, that we have since thought it useless to urge further, in this respect, the vain defence of private rights and general interests. Our "last words," however, on this subject, are embodied in a report to the Board of Agriculture, on the "Obstacles to agricultural improvement caused by govermental regulation," and which we had designed to print

in the Farmers' Register, before the close of this volume, and the end of our connexion with the publication, but which now must necessarily be excluded, for want of room.

In the following article will be seen views on this same subject, and estimates of loss thereby incurred, from Pennsylvania. But there the law of enclosure, bad as this writer shows its operation to be, is not half so costly as the law of Virginia would be there. In Pennsylvania, as we understand, and in most if not all other states north of Virginia, hogs are not permitted by law to go at large, and therefore the fences are not required to exclude hogs, and therefore they need not have more than half as many rails, or to cost more than half the money. If the law of Virginia was in force in Pennsylvania, the following estimate of the cost of fencing would have to be increased 100 per cent.; or if in Virginia there was introduced merely the partial relief which the law of Pennsylvania would afford, the present enormous cost of fences might be reduced one half.—Ed. F. R.]

From the Philadelphia Public Ledger.

One of the greatest differences between the United States and any civilized country of Europe, which an agricultural traveller would discover in passing over both, is in the *fences*. In Europe, nothing is fenced but the pasture. In the United States, every thing is fenced but the pasture. In the former, every proprietor of cattle fences them against trespass on his neighbors. In the latter, every proprietor of crops fences them against the cattle of every body. In the former, he may pass over extensive regions of growing crops, without seeing a single fence upon the road, or a single animal at liberty in it. In the latter he could not find a mile of highway without fences on both sides, and scarcely travel a mile without meeting cattle at large.

Which custom is the best? The question is easily decided by a calculation of the cost. Every American farmer will say that fencing is his greatest agricultural expense, and that he incurs this expense because fencing is his first agricultural want. He will say that a farm without a fence is like a house without a chimney, or a ship without masts and a rudder, a thing utterly useless, because incapable of being used. Therefore in buying an old farm, his first inquiry is about the fences; and in buying a new one, his first care is to fence it. A western farmer, who buys new land, will say that he must *clear* and *fence* before he can raise a crop. All that is wrong. Instead of fencing crops, the farmer should fence cattle; he should build fences merely to confine cattle, instead of building fences every where to confine every thing against cattle. Let us suppose a farm extending a mile upon each side of a highway, and half a mile at right angles to the highway upon each side, and containing fifty acres of pasture in one body. This farm contains a square mile, or six hundred and forty acres. According to the American system, each half of this farm would be surrounded by a fence, and almost every portion within their enclosures would be fenced excepting the pasture. Thus the mowing grounds would be fenced, the corn-fields would be fenced, the wheat fields would be fenced, every thing would be fenced but the pasture; and upon a moderate computation, this farm would contain ten miles of fence. Thus two miles would bound the highway, two more parallel with these, would divide it from the adjacent land and the half mile at each end, on each side of the highway, would amount to two miles more, the whole being six miles; and the fencing of fields within this outside fence against neighbors and the highway, would amount to four miles. Ten miles contain 3,200 rods; and estimating the first cost of this fence at two dollars for the rod, we shall find a first cost of $6,400! The interest of this at six per cent. is only $384!! And if the annual expense of keeping this fence in perpetual repair be only twelve cents and a half per rod, though we believe it would be much more, the annual tax upon this farm for fencing, besides the interest on the capital sunk, would be $400! Therefore the whole annual expense of this fencing is $784!!

Now let us examine the European system. Under this, all fencing would be dispensed with excepting that for the pasture; and if this, containing fifty acres, be ten acres in length by five in breadth, it would require 480 or 360 rods of fence. An acre contains 160 square rods, or a space 20 rods in length and 8 rods in breadth. Then if this field were 200 rods in length and forty in breadth, or 100 in length and 80 in breadth, it would in either case, contain an area of 8000 rods, or 50 acres. Any other combination of length and breadth upon fifty acres would give a length of fence approximating to one or the other of these numbers. But assuming the highest number 480 rods, we find a first cost for fencing the pasture of $960, an annual interest upon it of $57.60, and an annual tax for repairs, of $60, and a whole annual tax of $117.60. The reader will perceive some difference in capital sunk between $6400 and 960; and in annual tax between $784 and 117.60! The capital saved at first is only $5440; and the capital saved from annual tax in ten years, without any estimate of annual interest on the savings is only $6664! Such is the difference between fencing cattle *out* of a corn-field, and fencing them *in* a pasture! But this is not all the difference. At compound interest of six per cent., a capital is doubled in about twelve years. Then if two farmers begin, each with a square mile of land equally divided by a highway, and each containing fifty acres of pasture, both under equal cultivation but without fences, and one farmer adopt the American, and the other the European system of fencing, what will be the difference between them at the end of twelve years? Let us calculate. The American begins with fencing his farm completely, upon an expenditure of $6400, and keeps this fence in repair at an annual expenditure of $400. At the end of twelve years, he possesses a well fenced farm, which has cost him $12,800 in capital sunk for fences, and $4800 in annual repairs, and $1817 in interest on these repairs; the aggregate being $19,417! The European begins

with fencing his pasture, upon an expenditure of $960, and keeps this fence in repair at an annual expense of $60. We will also suppose that as both begin with a floating capital of $6400, the European puts the residue from the cost of his fence, or $5440, at compound interest. At the end of twelve years, the European has a farm with a well fenced pasture, which has cost $1920 in capital sunk, and $720 in annual repairs, and $294 in interest on these repairs; the aggregate being $2934. The difference between these aggregates is only $16,483!! Therefore, at the end of the twelve years, the American has a good farm and nothing else, and the European has a farm equally good, in other words equally productive with the same labor and culture, and $16,483 cash at interest! Yet these two men started together with precisely the same means, and all this difference is produced by different systems in fencing. Whoever will make, or read and understand the calculation, will perceive that fencing cattle *in* is much cheaper than fencing them *out*.

We commend this subject to the farmers of the great agricultural state of Pennsylvania. The evil of this erroneous system is an enormous tax upon agriculture, and the remedy is in their own hands. By enacting and enforcing severe laws for the confinement cattle, they will relieve themselves from a heavy burden. We shall hereafter offer a word upon the same subject to railroad corporations.

ACCOUNT OF THE OPERATION OF M'CORMICK'S VIRGINIA REAPER.

To the Editor of the Farmers' Register.

Cherieoke, November 17th, 1842.

When you were at my house during the past spring, I mentioned expecting to have in operation, during the then approaching harvest, a new reaping machine invented and patented by a Mr. McCormick, of Rockbridge county, in this state. You were pleased to request that I would furnish you, for publication in the Farmers' Register, the result of the operation of the machine. In regard to my promise, as well as in justice to the worthy inventor, it ought to have been complied with sooner; but circumstances, unnecessary now to refer to, have hitherto prevented me. But I hope it may not still be too late to afford any gentleman who may be so disposed time to send on his order for a machine for the next harvest.

The machines were received in due time for the then approaching harvest, and with them came the elder Mr. McCormick, the father of the patentee, to set them up and put them in operation, whom I found to be a worthy, intelligent old gentleman. As soon as the first machine was put together, we started it in a wet, damp day, in very heavy wheat, not yet ripe, but having the rust so badly as totally precluded the hope of its being of any value, or indeed that it would make any further progress in ripening. Mr. McCormick not seeming to fear, or have any doubt but that the machine would work in it, two mules were hitched, and, to my astonishment, under all the unfavorable existing circumstances, it operated without stoppage or difficulty, leaving the stubble as even, and the ground clean, not a straw standing or lying, as a parlor floor.

This wheat was of the kind you saw growing at my house, called the rock wheat, which I dare say would be the most productive wheat I ever saw, if it would mature well in our climate; but I fear from the stoutness of the straw, and quantity of fodder, it will not. As soon after as the weather permitted, and the wheat was ripe enough, the machines were put to work, and although then, from the repeated winds and rains which had fallen, we had no wheat that stood erect, and none that was not badly rusted, still they worked beautifully and without hindrance, saving the oft repeated rains—coming up fully I think to Mr. McCormick's advertisement, going over fully as much ground as stated by him, from 15 to 20 acres per day, and doing the work as neatly as it could be done. During the first days of harvest we had each day quite a troop of horsemen of the neighboring farmers following the reaper, all expressing their admiration and entire satisfaction at its performance. Among them were many cautious and judicious men, not easily led astray by novelties or humbugs, and one or two very good machinists. And one gentleman, who, you know, never gave in readily to new notions, the late Conrade Webb, esq., said it was the only thing of the kind he had ever seen which, instead of falling short of, exceeded his expectations. I cannot say with precision, as compared with cradles, how many it will take the place of; but this fact I know, that with 25 hands, counting the driver and raker, I could not secure in shocks much over half the wheat it cut in my rankest growth of straw. But that I think was greatly owing to the straw having become so rotten, that after the dew was off we could not bind with the wheat, and had to substitute willow bark to bind with. I think it a great labor-saving machine; but its greatest beauty is the neatness and clean manner in which the grain is saved, saving in good or heavy wheat, I am satisfied, more than a bushel of wheat to the acre more than can be saved by the cradle.

Having never seen one of Hussey's machines, I am unable to draw a comparison between them; but from what I have heard respecting it, should think this of McCormick's was constructed upon a different principle, and one more simple than the other, and I should suppose not liable to the same objections, as although it may not cut wheat as well wet with a heavy dew or rain, as indeed it does not, as when perfectly dry, still it operates, even under those circumstances, very well. Indeed I have seen J. A. Selden, esq. during this fall, and he told me he had two of Hussey's machines, but could not work them at all last harvest, on account of wet, which I suppose proves conclusively the superiority of McCormick's, as I cut all my crop with perfect ease and despatch.

From the manner in which it cut some patches of clover, herd's grass and timothy, it met with among the wheat, I am satisfied it may be adapted well for mowing purposes, and such is my conviction of the fact, that I have ordered one to be constructed for the purpose. The only localities in which I should suppose McCormick's reaper would not operate well, would be on Arator's narrow sharp-top beds, and in very rocky or stumpy land; in such situations the cradle would

have to be resorted to; but on hill-sides, or in crossing the ordinary 10 or 11 feet bed, I found no difficulty.

Upon the whole I think the agricultural public greatly indebted to Mr. McCormick for the talent and perseverance he has displayed in originating and perfecting the Virginia reaper, as in a few years I am satisfied it will, wherever circumstances admit, entirely supersede the cradle, and farmers will wonder how they could have gotten on before its invention. As it has not appeared in the Farmer's Register, I will first append a certificate I gave the elder Mr. McCormick, when he left my house, (who remarked at the time, that unless I was perfectly satisfied that the reaper had come up to the advertisement, he did not wish to be paid for them.)

"*Certificate.*—I have had three of Mr. C. H. McCormick's reapers at work this harvest, under my immediate observation; one on the farm on which I reside, and two others on farms under my management, and take pleasure in stating that the operation of all has been fully equal to my expectations, and indeed rather exceeded it, as indeed that of all others who witnessed the operation of the machine. Mr. McCormick's advertisement is fully sustained. It will certainly cut from 15 to 20 acres per day, if well attended to, and leave not a straw that can be brought in contact with the cutter. It has been worked this harvest under every disadvantage which it was possible almost to bring to bear against it, in consequence of the unprecedented wet weather we have had. It will cut any wheat that it is not too low for the reel and teeth to reach. It does not appear to me to be as liable to get out of order as a common cradle, and I should think it would be very durable. The reaper has cut all descriptions of wheat—green, ripe, rusted as badly as wheat could have it, lying and standing; and I have no hesitation in saying, that I believe it one of the most important agricultural improvements of the day; and, I think, that every farmer cutting fifty acres of decent wheat, would find it to his advantage to have one. No weather has prevented the reaper from working, except when the ground was so soft as to mire the wheels."

I am, respectfully, yours,
CORBIN BRAXTON.

June 28th, 1842.

EDITORIAL NOTICES TO SUBSCRIBERS.

The undersigned has the gratification of announcing to the friends and supporters of the Farmers' Register, that the property in and direction of that publication will be transferred, at the close of this year and of the current volume, to Thomas S. Pleasants, who will thereafter be the editor and publisher. To those persons who know this gentleman intimately, any recommendation would be superfluous. To others, and to the agricultural public in general, the undersigned begs leave to say, that Mr. Pleasants is well qualified, by the acquisition of general and varied information, and by extensive reading and sufficient practical experience in agriculture, and also as an excellent writer, to conduct an agricultural periodical of a high grade of character. The undersigned trusts that his present subscribers and the friends of the work will continue their support to the Farmers' Register under the editorial charge of his successor; whose abilities are likely to be as useful in discharge of that duty, and his editorial services and efforts more acceptable to the public in general, than have been those by which the publication has been recently conducted.

EDMUND RUFFIN,
Editor of Farmers' Register.

Petersburg, Va., Nov. 7, 1842.

The much larger portion of all the remainder of this volume, even with an extension of the number of extra pages allowed for the new edition of the 'Essay on Calcareous Manures,' will necessarily be taken up by that publication; all the essential portion of which will thus be given in (or as a supplement to) the current volume of the Farmers' Register. Should some other sheets of the Appendix to the Essay, of connected but not essential matters, be still excluded from this volume, they will be printed afterwards, and forwarded without charge to all the present and continuing subscribers who shall have paid their present dues before the close of this year.

The necessity for thus giving up so much of the remainder of the Farmers' Register to the 'Essay' will not cause the lessening of the usual amount of new and original matter; of which, as it will be seen, the portion of that work which accompanies this number, principally consists; and of such matter as, it is hoped, will not be unacceptable to its readers. This arrangement however will necessarily cause the postponing to the beginning of the next volume of the Farmers' Register, sundry communications, and especially those of greatest length, which it would be very gratifying to the editor to usher himself to the public. However, this necessary delay of these and of any subsequent communications will enable his successor to commence his editorial career with more *eclat*, as well as with more of usefulness and gratification to the supporters of his labors.

Of those indebted subscribers who may see this notice, and whose payments are in arrear merely because of inattention, it is earnestly requested

that they will remit their dues without more delay. If this be not done before the end of the current volume, the accounts will be necessarily transferred to other hands, and a large discount, even from the debts of the most responsible debtors, will necessarily be lost by the present creditor. The amount due from each indebted subscriber now on the list, was stated on the cover of No. 7. of the current volume.

ADDRESS OF WILLIAM C. RIVES,

President of the Agricultural Society of Albemarle, at their Annual Fair, on the 29th October, 1842. Printed by order of the Society.

Gentlemen of the Agricultural Society of Albemarle: This is the first occasion, since you did me the honor to make me your president, that I have had an opportunity of returning you my acknowledgments for so distinguished a proof of your confidence and regard. I feel how little of ability I have to advance, in an effective manner, the noble objects of our association; but whatever powers or faculties of good I possess shall be faithfully and zealously devoted to your service. The sense of my incompetency to fill the measure of your expectations is deeply enhanced, when I recollect who they were that have occupied this place before me—men, "who have held the scale of empire, ruled the storm of mighty war," and having served their country in its highest and most difficult stations, have given the serene evening of their days to the glorious task of redeeming and elevating its agriculture.* Of these illustrious citizens, my immediate and honored predecessor has, since our last annual meeting, closed his long and distinguished career of public usefulness. While his state and the nation at large mourn his loss, we cannot but feel it, in an especial manner, on an occasion like the present, when his imposing and animating figure was wont to mingle among us, and to impart fresh zeal to our common pursuits.

Every great undertaking of public utility seems destined to alternate periods of depression and revival. Ours, I trust, after a temporary relaxation of the interest felt in it, owing, probably, to the occupation of the public mind with more exciting, but certainly not more useful subjects, is now, it is to be hoped, on the eve of a revival, which will endue it with new energies, and carry it forward, with acceferated velocity, in the path of its usefulness. It seems impossible to question the high utility of such associations, when conducted with a right spirit. They stimulate the progress of improvement by the potent influence of mutual example, and the generous ardour of an awakened emulation. The mind, as well as the heart of man, is sociable, and seeks companionship and communion with other minds. We are told in a book of revered authority, that "iron sharpeneth iron—so a man sharpeneth the countenance of his friend." This social principle is the modern lever of Archimedes in all enterprises of public good, from making a railroad or canal, to christianizing a world. There is no country in which it has been so extensively and efficiently employed, for general purposes, as in our own. This characteristic feature of American society was remarked upon, with his accustomed discrimination and judgment, by a learned and distinguished foreigner who visited us a few years ago, and who, tracing its existence to the popular character of our institutions, affirmed, as a general philosophical truth, "that in *Democratic* countries, the science of association is the mother of science; the progress of all the rest depends on the progress it has made.*

If this be true as to the general objects of human science and improvement, how emphatically true is it in regard to that great interest with which we are specially connected. As cultivators of the soil, we live in a state of isolation and dispersion on our respective farms. While the members of other professions and callings are congregated in towns and cities, or are frequently brought together in the exercise of their professional duties, the farmer treads the daily paths of industry in the majestic solitude of Nature, relying, each one by himself, upon his own unaided judgment in the conduct of his daily toil. By the happy expedient of association, like the present, we are brought up periodically from the solitude of our daily pursuits, each one bringing with him as a contribution to the general fund of skill and knowledge, the results of his own separate experience and observation, to be thrown into a common stock for the benefit of all—for, in regard to every species of useful knowledge, *community of goods* is now, thanks to the spirit of the age, the established law of the social, and more especially of the agricultural world. The more experienced and successful of our brethren, too, bring with them, to the annual competitions of skill and improvement instituted by these associations, specimens of the choicest productions of their industry and care, animal, vegetable, and mechanical, while the helpmeets whom Heaven in its bounty has bestowed upon us, ever ready to assist in every good and useful work, grace the department of the exhibition which belongs to them, with the finer, but not less essential fabrics of their cunning household arts. Who can doubt the efficacy of institutions such as these to incite, stimulate and aid us in running the noble race of industry and improvement which Providence has set before us?

If any such there be, let him cast his recollection back to the appearance and condition of our farms some twenty-five years ago, when this society was established, and compare them as they were then with what they are now. Though we all feel there is abundant room still for improvement, yet so great is the progress which has been already effected, that the *identity* of certain farms which I could name has been almost literally lost in the change. Take, for example, Penpark, in this immediate vicinity, the farm of our worthy brother, Mr. Craven, one of the earliest, as well as most successful pioneers in this beneficent march of improvement, or Moorsbrook, the residence of another of our wor-

* Mr. Madison and Gov. Barbour were successively presidents of the Agricultural Society of Albemarle.

* De Tocqueville.

thy colleagues, Mr. Charles Meriwether, a more youthful but not less zealous votary of the cause of rural improvement, and who that knew them, as I recollect them, in their ruined, exhausted, and dilapidated condition, twenty-five years ago, would recognize them as the same places now, except by their unchanged *geographical* position? The wand of the magician, set in motion by this society, has passed over them, and in the place of the desolate nakedness of *red galls and gullies*, or that still more dreary type of poverty and neglect, the *broom-straw wilderness*, have succeeded the golden abundance of the rich and waving wheat field, or the bright verdure of hills clad in luxuriant clover and green-sward. Similar and equal, if not greater, changes have taken place upon many other farms within the sphere of this society, which could be named; and while their exterior aspect has been thus magically transformed, it would not be risking too much to say, that within the same period, their actual marketable productions have been, at least, tripled. If any should be inclined to set down these results to the credit of the general spirit of improvement, which has more or less pervaded the country at large, within some years past, rather than to any influence exerted by this society, I shall be pardoned for referring them, in no invidious sense, to the marked and acknowledged difference in the progress of agricultural improvement between this and adjoining counties possessing similar natural advantages, but not hitherto profiting, in an equal degree, of the stimulants and aids derived from associations like ours.

While the success of the past supplies us with abundant motives for perseverance, the prospects of the future afford a yet stronger incentive to increased exertion and zeal. Agriculture, as a science, may be said to be as yet in its infancy. The researches of learned and inquisitive men, within the last ten or fifteen years, have thrown a new light upon some of the most important processes of Nature, concerned in the rearing and bringing to maturity the productions of the earth. *Organic* chemistry, which has done so much lately towards revealing and explaining those processes, has almost wholly had its origin, as a distinct branch of science, within that period. Every rational system of agriculture must be bottomed on a knowledge and application of these principles. In what manner plants carry on their nutrition and growth—what substances contribute to their nourishment and support, and in what form enter into their constitution,—by what organization they appropriate and assimilate their food—the structure and functions of their different organs,—the sources from which their supplies of food are mainly derived, whether from the earth or from the air,—the composition, ingredients, and influence of the soils in which they grow,—the chemical action of the various manures employed to promote their growth—all these are matters of which the agriculturist should possess a sound and correct knowledge, if he would practise his profession with intelligence and success. The elementary principles of these inquiries, he derives from the chemist, the vegetable physiologist, the mineralogist, the geologist;—but much remains to be done by his own enlightened and discriminating observation. The farmer, indeed, is the fellow-laborer of the man of science in prosecuting his researches into all the arcana of the vegetable economy. His true character is that of an *experimental* philosopher, whose operations in the vast laboratory of Nature are the indispensable complement of those performed in the laboratory of the chemist.

Here, then, is a new and important field for the usefulness of agricultural societies. It is under their encouragement and supervision that a well-digested series of accurate and skilful experiments can be most advantageously instituted and conducted, to aid in the advancement of agricultural science, and to test the theories on which some of the most essential problems of practical agriculture depend. The importance of this desideratum has been long felt by men of science. Sir Humphry Davy, in his well known lectures on agricultural chemistry, remarks, "that nothing is more wanting in agriculture than *experiments*, in which all the circumstances are *minutely and scientifically* detailed, and that this art will advance, in proportion as it *becomes exact* in its methods." In this most useful branch of human knowledge, we may freely and without reproach indulge the passion of the day for *mesmerising*. We may commune with Nature in her sleep, interrogate her on her mysterious laws, elicit the secrets of her most hidden processes, and turn the revelations thus obtained to the highest practical benefit of our species. I will take the liberty, on another occasion, of inviting the attention of the society to some suggestions in detail for extending our usefulness, in this respect.

May we not hope that the professors of science, in return for such services as we may be enabled to render to the cause of liberal knowledge by our experimental operations in testing and illustrating its principles, will cheerfully come forward, from time to time to aid and enlighten us by their theoretical and philosophical views of the phenomena of Nature, and of the true methods of investigation and improvement. It is, I am sure, only necessary to make the appeal, to have it promptly and zealously responded to. Nothing has more strikingly distinguished the utilitarian age in which we live, than the honorable anxiety of men of science to apply the results of their researches and discoveries to the practical purposes of life, and thus, in their day and generation, to add to the amount of *actual, positive* good in the world. To all who are animated with this noble spirit, there can be no higher encouragement and reward, than to find the active classes of society appreciating, at their just value, the aids which science is capable of affording to their industrious pursuits. The late accounts from England bring us information of Liebig, the great German chemist, whose recent work on organic chemistry marks a new and prominent era in the history of science, mingling with the farmers of Yorkshire, at their cattle shows and agricultural meetings, and expounding his theories in familiar popular addresses. The distinguished geologists of that country, Buckland, Murchison, De la Beche, it is well known, have zealously complied with the calls made upon them, by undertaking gratuitously, geological surveys of the soils and subsoils of extensive agricultural districts. In our own country, the labors of Professors Hitchcock, Dana, Jackson, and others, attest the same sedulous and faithful attention, on the part of men of science in repub-

lican America, to the interests of practical agriculture; and I need not, I am sure, go beyond the limits of our own society for a distinguished example of a like public spirit in a learned professor, whose labors are so well known to us.*

It is the province of associations like ours, gentlemen, to invite and bring forth the contributions of men of science to the cause of practical improvement. The great work of Leibig, to which I have just referred, was prepared at the special instance of the British Association for the advancement of Science. The lectures of Sir Humphry Davy on Agricultural Chemistry, which gave the first marked impetus to the applications of science to agriculture, were delivered at the request, and in the presence of the Board of Agriculture of England. A mere *county* agricultural association in England, resembling in every respect our own, has recently had the good fortune of bringing forth by its encouragement and intervention, a work of extraordinary merit, which, for the popular and intelligible form in which its instructions are conveyed, as well as for the body of sound science it contains, is probably destined to replace all its predecessors. I refer to the lectures of Professor Johnson "on Agricultural Chemistry and Geology;" the first part of which only has yet appeared, but which affords the promise of a *code* of instruction, when completed, of the highest value to the practical agriculturist. These admirable lectures were delivered before the *Durham County Agricultural Society*, and the *members of the Durham Farmers' Club*, in a style of explanation so lucid and comprehensible, as to call for no previous technical knowledge of the subjects of which they treat. Here is an example worthy of imitation. We have already shown our sense of the intimate and important connexion between the objects of our society and the investigations of science, by making the learned professors of our University, ex officio, honorary members of this association. Shall we not invite them, from time to time, to bring the lights of their several departments of science, through the medium of popular lectures, to direct and illuminate the paths of our agricultural labors, and to sustain and embellish, by the efforts of their genius, the chief pillar in the edifice of our national prosperity and grandeur? Shall we not lay public spirited men of science every where under contribution in the same holy cause? I shall venture to propose this to you, gentlemen, in the firm confidence that an appeal to the patriotism of American science can never be made in vain.

By the means here suggested, the usefulness of our society may be greatly enlarged, and much may be done by its instrumentality for the interests of agriculture. But yet, other measures of a wider scope are demanded by those interests. A public endowment, under the patronage of the state, for instruction in the principles and practice of agriculture, is imperatively due to that great class of the community, which is immediately connected with the cultivation of the earth. We have, in great number, schools of law, schools of medicine, schools of general literature, but none of agriculture. Why is this so? The recent census shows, that the number of persons engaged in agriculture, is four times greater than the whole number of persons employed in commerce, manufactures, the learned professions, and trades of every description, all put together. Does not every consideration of policy and justice, then, require the provision of some means of professional education, in an art, to which so predominant and vital a portion of the industry and worth of the country is devoted. Is agriculture alone to be degraded into a vulgar and empirical pursuit, which requires no liberal instruction? On the contrary, there is no other profession, I will venture to affirm, which demands, for its intelligent exercise, so wide a range of scientific knowledge. It embraces within its scope, by a direct and necessary dependence, the domain of chemistry, botany, vegetable physiology, geology, mineralogy, meteorology, zoology, mechanical philosophy, not to speak of the moral and political sciences which have so important a bearing, in many respects, upon some of its highest interests. To which of the *learned* professions, so called, I would ask, is so large a group of kindred sciences associated in such close and intimate relationship?

These considerations are making themselves daily more and more felt, and are arousing public attention, in every enlightened community, to the just claims of agricultural education. A professorship of agriculture has been long since established in the universities of Edinburgh and Dublin; and from the former has recently proceeded one of the most valuable works on the "Elements of Practical Agriculture" ever published. If distinct professorships of agriculture have not yet been founded in the English universities, arrangements are in progress for establishing them; and in the mean time lectures of distinguished ability have been delivered on the subject by some of their learned professors—among which it would be inexcusable not to mention particularly the lectures of Professor Daubeny of the University of Oxford. It is time that Virginia should acquit herself of the debt which every enlightened and especially every republican commonwealth owes to this great primordial interest of society. We must have a professorship of agriculture in our University as a part of the general course of liberal studies, to furnish our young men, when they quit its walls, with a competent knowledge of the principles of a profession which so many of them embrace in after life. In addition to this, there should be established in connexion with the University a *special agricultural institute*, designed for those who might not wish or find it convenient to follow the general course of University studies, but whose object would be to acquire in shorter time or at less expense, the professional education of an instructed agriculturist, as well as the general accomplishments of an intelligent and useful citizen. In this department, theory and practice should go hand in hand; and for that purpose, a model and experimental farm should be attached to the institute, to be conducted under the most skilful supervision and management, and to afford examples of the most improved methods of culture and fertilization.

Of such an institution, a perfect exemplar, tested by forty years of successful experience, is presented to us, in the admirable and celebrated establishment of Von Fellenberg, at Hofwyl, in Switzerland. I am spared the necessity of details in the development of this suggestion, by simply

* Professor Rogers.

referring to that well known establishment as a general model, admitting readily of modifications, where a difference of circumstances may be supposed to require them. It was my good fortune, during my residence in Europe, to visit this classic spot; and I can safely say, that I saw nothing in the palaces of kings, in the museums of the fine arts, in the gorgeous displays of wealth and power, on every hand, which impressed me with half the admiration I felt in contemplating the modest, but noble establishment of the Swiss republican patriot and sage. Agriculture he chose as the basis of his enterprise—and by the happy combination, in the training of his pupils, of intellectual and bodily labor, mutually relieving and giving zest to each other, he has achieved those prodigies of moral and physical improvement, which have drawn upon his institution the earnest attention and applause of the civilized world. It has furnished to continental Europe the best models of its agriculture, while it has sent forth into its various states and kingdoms some of their most useful, virtuous, and enlightened citizens. At the same time, the model farm of Hofwyl stands a proud refutation of all the stereotyped satires, so frequently indulged, on scientific farming, as the accounts of the establishment, kept with minute mercantile exactness, disclose, through a series of years, a net profit of eight and a half per cent. upon the whole capital employed—a rate of profit with which, I venture to say, any of us *practical* farmers would be more than content.

I have thought it not unsuitable to the present occasion, gentlemen, to present to you these observations on the means of extending the usefulness of our society, of elevating the standard of our profession, and of promoting the progress of agricultural science, in which the highest prosperity of the state, as well as our own personal interests and feelings, is so deeply concerned. If I shall have thrown out any thing which shall appear to you worthy of being further pursued, I shall esteem myself happy in awakening the interest of those, whose intelligent exertions, concurring with those of our agricultural brethren elsewhere, must ensure by their united moral influence, success to whatever object of public good they may espouse.

Pass we now from these topics to those of a more familiar character connected with *operative* agriculture. The bountiful Author of our being, gentlemen, has given to man dominion over the earth; and over all its productions, but coupled with the grant the express condition and injunction, that he should *subdue* it by his industry and toil. It is no part of the scheme of Divine Providence, that spontaneous nature should supply the wants of man. On the contrary, there is hardly any thing which nature presents to us in a state which supersedes the necessity of human labor to make some change in it, to prepare it for the use of man. Political economists, indeed, tell us that *labor* is the *only* source of the necessaries and conveniences of life, or what they call *wealth*. Whatever exception may be taken to this proposition, in its unqualified strictness, it is, nevertheless, undeniable that human labor is, by far, the most important constituent in almost all articles consumed by man—even the ordinary products of the earth. The great philosopher, Locke, remarks, that "if we will rightly consider things as they come to *our use*, and cast up the several expenses about them, what is purely owing to *nature*, and what to *labor*, we shall find that, in most of them, *ninety-nine hundredths* are wholly to be put to the account of *labor*." And he adds, that "it would be a strange catalogue of things that the industry of man provided and made use of, *about every loaf of bread*, before it came to our use, if we could trace them."* Let us not repine at this law of our being, but recognize in it a new proof of the goodness and wisdom of Divine Providence, which thus supplies us with constant motives to that active exertion of our faculties, mental and bodily, in which only the true dignity and happiness of man are to be found.

The earth, then, is given to us in a state unfit and incompetent for the support of civilized man, but with varied and indefinite capacities of production, to be drawn forth by human industry and art. There is no part of its primitive surface which does not stand in need of *improvement*, in some form or other, by *artificial* means. This is the fundamental principle of agriculture as an art, and points to a constantly progressive improvement as the end of every generous system of farming. No man should be content simply to preserve his lands in the condition in which they are. The poor should be made rich, and the rich richer; and such is the efficacy of artificial means of improvement, that what was originally the poorest land in Europe, (I refer to the light sandy soils of Flanders,) is now propably the richest—so that Flemish husbandry has become synonymous with the perfection of fertility and productiveness. In effecting this extraordinary triumph over the disadvantages of Nature, much doubtless has been done by good tillage, deep ploughing, thorough draining, and a judicious rotation of crops; but the most efficient agent has been the minute care in collecting and preserving, and unwearied diligence in the application, of *manures*. These, indeed, in connexion with proper culture, are the "charms and mighty magic" by which the wonder-working power of agricultural improvement has every where wrought its miracles. It is alike curious and encouraging to observe how the catalogue of these precious resources is daily extending by the discoveries of modern science, and the inquisitive spirit of the human mind. In addition to the numerous class of vegetable and animal manures, so long known, and whose virtues have been tested by centuries of experience, it is now discovered that the respective compounds of lime and magnesia in *bones*, and the peculiar chemical affinities of *charcoal powder* and *soot*, have placed them high on the list of valuable fertilizers.

But it is chiefly in the wide field of mineral manures, and in the bowels of the earth, that the researches of the chemist and the geologist are from time to time unfolding new resources for stimulating and increasing the productiveness of its surface. —I need not bring to your view any of these modern discoveries, of which you will obtain a far more satisfactory knowledge from the publications which treat of them. But I cannot pass without

* See Treatise of Civil Government, b. ii., chap. v., s. 40 and 43.

noticing the extraordinary and cheering results, which have already followed, and are likely to be still farther produced, in a portion of our own state, by the use, as a manure, of those beds *of fossil shells*, which are found deposited, in such large abundance, throughout the tide-water region, and to which the denomination of *marl* is now generally applied. And here we have occasion to remark a striking example of that wise economy of Providenne to which I have already referred. The region in which these large deposites of marl are found is distinguished, for the most part, by natural soils of an inferior fertility; but beneath their surface Nature has placed, in liberal measure, the means of enriching them to any extent, thus inviting the enterprise and industry of man to their improvement. It was the fortune of a public spirited and intelligent Virginian, at a critical moment for his country, to perceive the inestimable value of this hidden talent; and, under the awakening influence of his able writings and experimental demonstrations, lower Virginia is now undergoing one of the most remarkable transformations of this age of improvement. I need not say that I speak of the able author of the "Essay on Calcareous Manures"—a work that has already taken a distinguished place among the agricultural classics of the English language, and which will transmit the name of its author to future times as a public benefactor.

You are not unmindful, gentlemen, that Nature has placed on either side of us, in the region we occupy, one of the most efficient of this family of calcareous manures. I refer to the vein of limestone which borders us on the east, running parallel with, and at about a mile's distance from the base of the South-west mountains, and the broader field of it which skirts us on the west, running along the western base of the Blue Ridge mountains. These bodies of limestone run in parallel directions through the entire width of the state, and at about an average distance of twenty-five miles from each other. It becomes, therefore, a matter of interest to the whole range of counties lying in this situation, and not inappropriately called the *Piedmont* counties of Virginia, to enquire how far we may profitably avail ourselves of this material, which Nature has placed on either hand of us, for the improvement of our lands. It strikes one at first with some surprise, that lime having been advantageously employed from the earliest times as a manure, doubts should still exsit, in various localities, as to the benefits of its application. But when it is recollected that it belongs to the class of what are called *special* manures, adapted to particular soils, and even on the soils to which it is adapted, requiring to be used in different quantities, according to the condition of the land to which it is applied, this spirit of caution is not an unreasonable one.

Being somewhat of a pioneer in the lime husbandry in this portion of the state, I feel myself called on, gentlemen, to give you the results of my experience. I have used about 12,000 bushels of it, (slaked measure,) from a quarry opened for the purpose on my own land, which has been spread over about 150 acres, at an average, therefore, of 80 bushels to the acre. Some accounts which I had read of its effects elsewhere, not expressed with the accuracy and discrimination so much to be desired in such communications, had led me to expect a decided effect from it upon the *growing* crop—by which I mean the crop, of either corn or wheat, immediately succeeding the application of the lime. In this, I was disappointed; but the discrepancy is probably accounted for by the fact, that I have not hitherto used lime in combination with putrescent manures from the farm yard or the stable, while others have most probably done so, though that circumstance was not noted in the communications to which I refer. My first disappointment, however, in regard to the effects on the growing crop, was more than compensated by the marked, unequivocal, and decided effect I have never failed to perceive from the lime *alone* in the *clover* succeeding the wheat crop—with which it has been my general practice to apply the lime at the time of seeding, harrowing in the lime and wheat at one and the same operation. The increased luxuriance of the clover has furnished, of course, conclusive evidence of the improvement of the land, from the application of the lime, and has, in its turn, enured to the still further amelioration of the soil. All my observations, in regard to lime, would lead me to the opinion, that it is the most *permanent* of all manures, and to concur in the conclusion, so forcibly stated by Dr. James Anderson, one of the most copious and able of all the British writers on agriculture, who, in his most valuable "Essay on Lime," says, "*that its effects on the soil will be felt, perhaps, as long as the soil exists*"—and this conclusion he justifies by the mode of its action, altering the nature and constitution of the soil itself, and enduing it with capacities and affinities which it never before possessed. My applications of lime have been almost entirely on a close, gravelly loam, of a brownish or gray color—and the result of a single experiment, on land of a different description, would lead me to believe, that it is not adapted to the red ferruginous clay soils of the sides and base of our Southwest mountains. It is a proverb in England and Scotland, that,

> "He that marls sand
> Will soon buy land:
> But he that marls clay
> Throws all away."

The reason that Dr. Anderson suggests for the comparative inefficiency of marl on clay soils is, that clay forms a large proportion of marl, and the addition of clay to clay, therefore, cannot be expected to produce so good an effect. The same reasoning would furnish a solution of the supposed want of adaptation of lime to the red clay soils of the Southwest mountains *proper*, and of its unquestionable efficacy on the adjacent gray loams, as a chemical analysis of the two soils has, I understand, disclosed the existence already of two per cent. of lime in the former, and of hardly any sensible quantity whatever in the latter.

Nothing can be more certain, than the highly beneficial effects of lime, as a manure, on a large majority of our soils, in which, according to an analysis by Mr. Ruffin, of as many as sixteen different specimens taken from various and distant parts of the state, lime is very rarely ever found as an original and natural ingredient. The important practical question then is, whether the expense of the application is justified by the benefits of the manure? This is a question which every person must determine for himself, accord-

ing to his particular position, and his own views of profit and loss. For myself, I will only say, that I have always found the best application I could make, of money derived from the land, was to return it back to the land, in the shape of improvement. There is no investment of capital which can be more safe, and in ninety-nine out of a hundred cases, none half so profitable. If by laying out five dollars in manure, on an acre of land, you make it produce you twenty bushels of wheat, worth a dollar a bushel, when it produced but five bushels before, and this product is renewed to you every four years, in an ordinary rotation of crops, have you not secured an interest of one hundred per cent. on the outlay you have made, and, at the same time, increased the value of your land four hundred per cent.? And yet results such as these, extravagant as they may seem, and though we may be unconscious of them ourselves, are often achieved by a liberal and spirited system of improvement. The *passion* of us Virginia farmers is to acquire more land—not to make the land we already possess more productive. If a farmer should add yearly to his possessions a hundred acres of land, he would doubtless consider himself getting along very prosperously in the world. But if at no greater expense he can make a hundred acres of land twice or thrice as productive as they were before, is he not doing much better, with the great advantage of having a more compact surface on which to concentrate his labor and care.

The misfortune of our Virginia agriculture is, that we have already too much land for the labor we can bring to cultivate it. As we are not likely to make a voluntary curtailment of the extent of our farms, the greatest practical reform that can be introduced into their management is to curtail the arable surface on each, and to lay down a larger portion of our lands to grass. Instead of wasting the energies of our soil by annually spreading over a wide surface a superficial, negligent, and teazing cultivation, yielding comparatively nothing, how much better would it be to cultivate one-half or one-third of the space we now do, to concentrate upon that all our resources of labor and improvement, and to leave the rest to recruit itself by the healing processes of Nature. Liebig has explained in a very ingenious and philosophical manner the process by which lands laid down to grass are constantly renewing and improving themselves, and has thus confirmed the deductions of our own observation by the demonstrations of science. Should any one doubt whether we should derive from the reduced surface, better cultivated, a product equal to that of the whole under inadequate culture, let him recollect the instructive story told by old Columella, in his *De re rustica*, of a Roman vine-dresser who had a vineyard and two daughters. When his eldest daughter was married, he gave her a third of the vineyard for a portion, and yet he had the same quantity of fruit as before; when his second daughter was married, he gave her the half of what remained, and still the produce of his vineyard was undiminished. This anecdote of the Roman agriculturists, gentlemen, points the full force of its moral against that fatal mania for emigration which has hitherto carried off so large and valuable a portion of our population to seek wider domains for themselves and their families in the prairies of the west. It is not more land that we need. We have enough and more than enough already, if properly cultivated and improved, for ourselves and our children after us. It is industry, improvement, good husbandry we want, to develope the natural capabilities of our soil, and to make it adequate to every reasonable wish, and even to the fondest dreams of prosperity and wealth. With these, seconding the gifts of Providence by which we are surrounded, we shall have nothing to envy to the untamed abundance of the west, tempting us from the cherished scenes of our childhood, and the hallowed tombs of our ancestors. I am happy to believe, gentlemen, that a brighter day is now dawning upon us, and that the eminent natural advantages and superior capabilities of Virginia are beginning to be appreciated at their true worth, by the citizens of our sister states, as well as to be more and more felt by her own children. While emigration from our borders has, in a great measure, ceased, other states are beginning, in their turn, to send to us tributes of their moral, industrious, and enterprising population, attracted hither by the advantages of our climate, our numerous navigable rivers, our water power, our mineral resources, our favorable geographical position, our kind and improvable soils. Of these welcome swarms from kindred hives, I have recently become acquainted with one of so interesting a character, embracing persons of great respectability, from one of the oldest and most highly improved counties in the state of New York, (the county of Dutchess,) that I cannot deny myself the gratification of reading to you a letter I have recently received from an intelligent citizen of the county of Fairfax, in answer to some inquiries I addressed to him, giving me the particulars of their settlement and establishment in that county.

(Here Mr. Rives read the letter referred to, as follows:)

I proceed to make the following answers to your inquiries:

How many citizens of New York have purchased land in your county?

Ans. From the best information I can obtain, there are about fifty-six families that have purchased land, some of which have not removed, but the greater part of them now reside in the county; these families average from three to five persons, making about two hundred persons in all.

How much land in all have they purchased?

Ans. Thirteen thousand five hundred and thirty two acres. They have very generally preferred small sized farms, from one hundred and fifty to two hundred acres, but they have been compelled to purchase large farms, or rather large tracts of land, which they are cutting up as fast as they can.

Have they been sufficiently long established to indicate what their system of farming may be?

Answer.—I do not think they have. But their system, so far as I have observed it, is in favor of the cultivation of grass, over that of grain, and thus far, they have made rapid improvements in the appearance of their farms, if nothing else. They remark, that if clover will grow well, they are satisfied they can make the land rich.

Have they used lime, and with what effect?

Answer.—I do not think they have used lime

to any extent, so as to know what its effects will be.

What appears to be the prospect of a farther accession of settlers from that quarter?

Answer. The prospect seems to be very good. I have no doubt from the information I have obtained, that they will continue to come amongst us. They seem to be delighted with the climate, and generally pleased with our people, and I know of no one who has settled here who is desirous to return to the north. There is now a strong disposition, amongst the wealthy farmers of Dutchess county (the richest county in the state) to purchase lands and remove to this county. Much might be done by our legislators to promote this emigration, so important to our impoverished and wilderness state; but I forbear to enter upon this topic at the present."

This agricultural immigration into our state from New York marks a new and cheering era in the history and fortunes of Virginia. It has all taken place within two or three years past, and consists of some of the most intelligent, worthy and substantial farmers of one of the most improved and fertile districts of the north. It is impossible to prize too highly such an accession of industry, capital and intelligence to our agricultural community, or to estimate the full extent of the good effects, direct and consequential, which it may bring in its train. What an emphatic homage is it, gentlemen, to the superior natural advantages of our state, which have hitherto been too much slighted and neglected by ourselves. It is but the beginning of the influx of enterprise, skill and wealth which will flow in upon us from other states, while we retain in contentment and happiness our own native population, *if* by improved systems of husbandry we do *our* part in developing and demonstrating the capabilities and productive powers of our soil, under the hand of persevering and enlightened culture. What a field of usefulness to our country is here opened to us all! It is a race of noble emulation in which we may all contend for the prize of true patriotism. It is an oft-quoted saying of a celebrated writer, "that whoever makes two ears of corn, or two blades of grass, to grow where only one grew before, deserves better of mankind, and performs more essential service to his country than the whole race of politicians put together." How much is the merit and the magnitude of this service increased, when at the same time by the example of his fruitful labors he attaches, with new and indissoluble ties, his children and his neighbors to the land of their birth, and brings a dozen useful citizens into the state, where aforetime a dozen useful citizens were accustomed to leave it. Every man who performs his part in such a work, however obscure his destiny in other respects, or noiseless his path of life, is a public benefactor, and a patriot. The humblest laborer in such a cause,

——"Serves his country, recompenses well
The state beneath the shadow of whose vine
He sits secure, and in the scale of life
Holds no ignoble, if a slighted place.
The man whose virtues are more felt than seen,
Must drop indeed the hope of noisy praise;
But he may boast what few that win it can,
That if his country stand not by his skill,
At least his follies have not wrought her fall."

THE MEDITERRANEAN WHEAT.

For the Farmers' Register.

In a communication which I made to the Farmers' Register, which appeared in the number for February, I mentioned that I had procured some wheat from Pennsylvania, called there the Mediterranean, which was said to resist the Hessian fly. I have since learnt that it was brought to this country by Commodore Jacob Jones. After it had been grown in Delaware, some of it was sent by Doctor Nandine, of Wilmington, to Virginia, where it is called fly proof. Last year, about the 10th of October, I sowed ten bushels on two and a half acres, from which I gathered fifty-six. As no part of my crop was injured by the fly, from my experience, I can say nothing of its fly proof quality; but it ripened one week earlier than my other wheat, and escaped the rust, by which my general crop was diminished one-half in quantity. I have this year sown forty-four bushels, on twenty-two acres; and should I live to gather my crop, and the Register then be in life, (which I sincerely hope,) I will give you an account of it. Since the first appearance of the Hessian fly, on the Eastern Shore of Maryland, no wheat has been found to be proof against it; and our crops are often much injured by the rust. If experience shall prove this wheat to be exempt from both, it will be of great value to the country.

I heard from a gentleman of this county, that the Baltimore millers placed a low estimate upon the Mediterranean wheat, and was desirous to ascertain its real value. I had two bushels ground at a neighborhood mill; I directed the miller to weigh the wheat and the fine flour. He informed me that they weighed 120 pounds; and, after deducting one-eighth for toll, produced 69 pounds of fine flour. It made good bread, in the estimation of my family; and, as a further test, I sent a specimen to a lady in Talbot, and another in this county, both of them well experienced in these matters, who concurred in our opinion that the bread was good, but inferior to what is made from our white wheat.

In a former number of the Register you stated that you would be pleased to receive any uncommon fossils found in our marl banks. More than twenty-five years ago, in ditching some low ground, I found a large tooth, which was given to Mr. Haden, a dentist in Baltimore, who pronounced it to be the tooth of an Asiatic elephant. Since, when near the spot, I found in a marl bank two others corresponding with the first. One of them I have presented to the Baltimore museum; the superintendent says it belonged to the American mastodon. The other I still have, it weighs 12 pounds; and, if you desire to have it, I will have it put on board of any vessel you shall name, trading between Petersburg and Baltimore.

If the Register shall terminate at the end of the year, this will close my correspondence, and I avail myself of this occasion to express the pleasure and instruction I have received from the Register, and the regret I feel at its cessation.

WM. CARMICHAEL.

Wye, Q. A. Co., E. S. Md.,
Nov. 16th, 1842.

[The gift offered by Mr. Carmichael will be accepted with pleasure. It may be sent (securely

covered) by the freight steamer from Baltimore. We trust, from the arrangements announced, that our correspondent will not lose what he has so much valued in the Farmers' Register; nor the publication lose the aid of his communications, which have heretofore given to the work much of its value.—Ed.]

HEMP CULTURE FOR NORTH CAROLINA.

To the Editor of the Farmers' Register.

Big Lick, Roanoke, Nov. 18th, 1842.

A cultivator of drained swamp land, in Washington county, North Carolina, desires to know whether hemp would be a crop suitable for his situation, as to soil and climate, and you appeal to your subscribers for the information.

As I am a hemp grower to some extent, and have taken a good deal of trouble to acquire all the information I could with regard to its culture and subsequent management, I will endeavor to satisfy your correspondent's inquiry.

The favorite soil of hemp is a deep, rich, dry, friable mould, neither liable to drown in wet, nor bake in dry weather. It is necessary that ground intended for hemp should have the most thorough preparation. It must be free from grass and trash and clods, and as perfectly pulverized as a garden bed. This will give all the seed an equal chance of vegetating. The plants will grow off together, and the crop will have that degree of thickness which is requisite to a great yield and a due degree of fineness in the stalk and lint. If the land is indifferently prepared, rough or foul, the seed in favorable spots will vegetate before the rest, and the growth is so rapid that they immediately shade the ground and so enfeeble the tardier plants that they never attain the height of the general crop. The consequence is, a thin crop, coarse stalks, harsh and indifferent lint, and a poor yield. From this your correspondent will be able to form a pretty correct notion of the adaptation of his soil. If his swamp land is thoroughly drained, there can be no question of its suitableness, from what I have understood of its texture. I learned from an agricultural tour made by yourself a few years since, that almost the whole of the peninsula between Albemarle and Pamlico Sounds, embracing several counties and an area of several thousand square miles, is exceedingly rich and productive when reclaimed. On the estate of an old college classmate, which you examined most minutely, you found a general surface soil of rich vegetable mould two and a half feet thick, with a close substratum of blue clay, which sub-soil, when brought to the surface and exposed to the atmosphere, crumbled readily, and was by no means deficient in fertility. Such a soil certainly possesses all the important constituents of a hemp soil, and I can only conceive of two circumstances which can possibly interfere with its successful culture. These are, the difficulty of keeping the reclaimed marsh perfectly dry, and the southern climate. As to the first, there is a most encouraging instance in my immediate neighborhood of successful cultivation on a reclaimed swamp, which is so deficient in compactness and solidity, that jumping with a man's weight on the surface will make the earth tremble for a circumference of fifty or sixty feet.

As to the second impediment, of climate, there may be something in it, as hemp has never been adopted as a *crop* in countries as far south as Carolina, while it has been uniformly the favorite staple of the extreme north. In those portions of our western country corresponding in latitude with Washington county, in North Carolina, the farmers have small patches of hemp, apparently as flourishing as the growth of more rigorous latitudes. The lint of the colder countries is said to be better. This, for aught I know, may be true; but I believe it is purely speculative, founded on conjecture, where there were no facts to build on. I have had frequent opportunities of examining the crops of upper Missouri and northern Kentucky, and I am fully satisfied that our crops in Roanoke are fully equal in every respect to either of them. *Here*, we are about two degrees south of the portion of Missouri alluded to, and the same number of degrees north of Albemarle Sound. Our altitude will enhance the difference in going towards the Atlantic; but if two degrees makes no sensible difference between Missouri and Roanoke, I would hardly think that two more degrees, even with a slight addition for altitude, could make any very material odds.

If you should receive nothing more satisfactory from other sources, and should think what is here contained of any interest to your correspondent, you are welcome to publish it.

Respectfully yours,

W. M. Peyton.

REPORT TO THE STATE BOARD OF AGRICULTURE OF VIRGINIA,

In reply to their inquiry as to the "*Obstacles to improvement, including the operation of the laws, or governmental regulation.*"*

By Edmund Ruffin.

It is not designed in this report to consider all the important obstacles to agricultural improvement in Virginia; but only a few of the most operative and injurious, and of which the existence and oppression are due entirely to the legislative policy of this commonwealth, and which may be removed, or greatly alleviated, easily, certainly, and most beneficially to agricultural and general interests, by legislative action.

The evils of this kind which most injuriously affect agricultural interests, and oppose agricultural improvement, are produced by the defects of

* As the length of this report made it inconvenient and improper to insert it entire in the few remaining and unappropriated pages of this volume, it was designed to omit it entirely, as was intimated in a previous page. But as there are different subjects treated of, under distinct heads, it has been determined to give an extract, which embraces a portion of these subjects, leaving the other and larger part of the report to be continued, in the first number of the new series of the Farmers' Register.—Ed. F. R.

the legal policy of Virginia in regard to, 1st, fencing, and trespasses of live-stock on crops—2d, the drainage of extensive swamps, or lands of sundry proprietors subject to inundation by one common stream—and 3d, the existence of mill-ponds injurious to health.

The pecuniary losses to the commonwealth produced continually by each one of these obstacles to improvement are enormous. But, in addition, the two latter evils annually produce injuries to the health, to the lives, and to the happiness of many thousands of persons, which cannot be estimated in money values, and which greatly exceed all possible extent of the pecuniary sacrifice. But, if dismissing from consideration and estimate these higher and far more precious interests, and having regard merely to the money value of the cost and of the products of the erroneous existing policy of Virginia in these three things only, the balance of annual loss thereby sustained, (after making full allowance for all gains from the system,) if correctly estimated, would amount to as much as a very large proportion of all the real agricultural profits derived from other and truly productive and valuable sources.

Neither is it the purpose of the writer to go fully into the discussion of even these three subjects, or to attempt to exhibit all the force of their operation as obstacles to agricultural improvement, and destroyers of agricultural profits. To embrace even the important details, would require the subjects to be treated at such length as would be unsuitable upon this occasion. In such general and cursory manner as is deemed suitable and requisite, the three subjects will now be treated in the order stated above.

I. The legal policy of Virginia in regard to enclosures, and trespasses.

Justice and policy have concurred in fixing as a general principle in the laws of civilized nations, that *each individual should be compelled to refrain from trespassing injuriously on the property, or otherwise doing wrong, either directly, or through others under his control, to any other person under the protection of the laws.* In Virginia, however, there is one most important exception to the general adoption of this principle. The whole land of our country is, in effect, deprived of this protection against trespassers and wrong-doers. Our law does not forbid A to permit his cattle to eat and destroy the growing or ripe crops of B; but compels B to secure his fields effectually against the entrance of the cattle, or otherwise maintains A as innocent. In this case the rule just named is reversed; and so far as our fields and crops are in question, the principle adopted is this: *each individual shall guard and protect his property from depredators, and every person is permitted to consume or destroy all that may not be well guarded.*

The injustice of this reversed rule would be readily admitted by any one who considered the question abstracted from the circumstances from which our policy sprang, or who was not in some degree blinded by being accustomed and reconciled to the practical operation of this policy. But I am no advocate for aiming at theoretical perfection in government, or consulting arithmetic and geometry, rather than the actual condition of men, to make rules for their direction. I freely admit that, at a former time, circumstances in Virginia required the general adoption of this policy—and that it is still expedient over a large portion of her territory. But in another large portion of the state, from changes of circumstances, this policy has become as injurious in its practical operation, as it is unjust in theory.

When our country was newly settled, the extent of cultivated land was very small compared to the forests and waste land, much of which, even in that state, was valuable for pasturage; and it was by far cheaper to fence in a few and small spots of arable land than the extensive woodland pastures, or *range* for stock; and the range was much too valuable to be abandoned. It was beneficial to every landholder that such should be the general plan of enclosures, although the open land thereby became one large common pasture, for the use of him who owned but little, or none of it, as much as for those who owned the largest shares. According to these views our legal policy with respect to enclosures was fixed; and from it all derived at first some benefit, though certainly the benefits were very unequally divided. The law, stated generally, requires that each owner of a field shall surround it with a good fence, of a certain height, or shall have no remedy against the intrusion of his neighbors' live stock.

But now the state of things in much the greater part of eastern Virginia is altogether changed. All the fertile land has long been cleared and made arable, and much more of such as is extremely poor is also under tillage. In districts where the soil is, or has been, of good quality, very little timber for fencing remains; and, consequently, the expense of fencing is increased greatly more than in proportion to the increased extent of enclosures. The remaining wood-land is poor, and so worthless for pasturage or *range* for stock of any kind, that many of the owners make no use of their unenclosed wood-land for that purpose. But this abandoning the use of their woodland (which in fact is not worth using by any one,) does not relieve the owner of the expense of fencing his arable land; and this is required merely that other persons may not be deprived of the use of his wood-land for range, which he does not consider worth using as such for his own live stock.

The great extent of fencing required bears especially hard on the tide-water region. There, on and near good lands, the original growths of durable pine and good oak have all been destroyed—and a choice has been already, or soon will be presented to every farmer, either to purchase suitable fencing timber at a distance, or to use the *old field* pines which form the second growth of his worn fields, and which are not more remarkable for their rapid growth, than for their rapidity in rotting, when used for fencing timber. There are no durable materials for dead fences, and the frequent divisions of lands, as well as the laws permitting stock of every kind to range at large, forbid or discourage the attempt to make live hedges. There are many farms which have five miles of perishable fences to keep in repair, that do not yield $500 of clear profit; and many other tracts are thrown out of cultivation, and yield nothing to their owners, (who in most cases are the especial *favorites* of our laws—widows or orphans—) because the expenses of lawful fencing would exceed the whole rent.

Under this system and these circumstances, farmers who make suitable enclosed pastures for their own live stock, (as every one ought to do for his own interest,) are burdened with the expense of two kinds of fencing, for two different objects. His own interest requires that he should make an enclosure to keep his own cattle *in*, and the law compels him to fence his cultivated lands, to keep the cattle of other people *out*.

It is impossible to estimate with any approach to accuracy the heavy loss caused to the farmers of eastern Virginia, by this unjust policy. But if each person will calculate the amount of his own individual loss, it will be sufficiently evident that the whole annual amount is enormous.

It is admitted that the evil of this policy is not so rated by all who bear even its heaviest burdens. There are many, who because they have never known any different state of things, can scarcely conceive the advantage of making every man restrain his own cattle within his own bounds. Therefore, even if the legislature were impressed with the opinions here advocated, it would be improper to make any general or sudden change in our system. Most of the benefits of a change might be secured, and the objections avoided, by partial changes of the law of enclosures, for such particular districts as would accept the offer by the voices of three-fourths of their proprietors, and they owning not less than three-fourths of the land within the boundaries of each district. If such a privilege was accepted by the owners of a district of five miles square, for example, they would still be bound to maintain at their joint expense a general enclosure in obedience to the general law, and to exclude the cattle of all persons residing without their limits. But the expense of such general enclosing fence would be very inconsiderable, and would be diminished to each individual in proportion to its greater extent. Such a plan would secure to every considerable tract of country either kind of policy that its inhabitants were decidedly in favor of—and would be free from every reasonable objection. If the people of any one neighborhood were permitted to adopt the change proposed, under proper restrictions, all the risk and loss of the trial would be confined to them, and if it succeeded, the whole community would participate in the benefit.

If our legal policy in this respect was altogether changed, there are many farmers who would still refuse to profit by the boon; and, from their fondness for close grazing their fields by as many cattle as can be kept alive through the year, would keep up their present amount of fencing, though their fields would be no longer liable to the depredations of any cattle but their own. But most persons would soon learn the benefit of pursuing a different course. Each farmer having to maintain his own cattle, would keep a smaller number, and confine them generally to a permanent pasture well enclosed: and by being necessarily reduced to one-fourth of their present numbers, and treated as well as the change of system would permit, the live stock would yield more products of every kind than at present. The lands kept for tillage, thrice as extensive as the enclosed pastures, if too poor to be grazed, might be safely left without a fence, until their improvement in after time may make enclosures necessary for the owner's interest. There can be no doubt, if permitted to get rid of the burden of making and repairing three fourths of our costly and perishable fences, that the change would be almost necessarily followed by greatly improved products from both live stock and tillage, as well as increased fertility to the whole country exempted from the usual impoverishing and unprofitable grazing of poor fields by poor cattle.

It is utterly impossible to approach an estimate of the annual cost and dead loss to agriculture caused by the construction and repairs of the proportion of fences which are totally useless to the owners' interests, and required by nothing but the penalties of the law of enclosures. If such an estimate could be correctly made, the amount exhibited would display a degree of voluntary sacrifice of wealth by the agricultural interest, without even any proportional gain to other interests, which would astonish both the imposers and sufferers of the burden. But, without pretending to any thing like accurate valuation, it can scarcely be doubted that in the eastern part of Virginia, the cost of useless fences to each farmer, on the general average, is fully twice as much as the amount of all the taxes he pays directly to the treasury of the commonwealth.

But if the change of the law of enclosures, to the extent required by justice and by the interests of agriculture, be hopeless—even to be introduced slowly and gradually and cautiously as proposed above, and only when, and to such extent as demanded by the majority of proprietors and for the greater share of the land of each particular district—still there is a partial but important alleviation of the burden of the present law, which might be permitted at once, and with scarcely any serious inconvenience to any interest or individual, even among those now unjustly favored by the law. This improvement would be made in merely restraining hogs from ranging at large; or to deprive that kind of stock alone of the protection (or freedom of trespassing) afforded by the general law. If that change only were made, it would lessen the whole cost of fencing by one half. A good "post and rail" fence, of three rails in height, on a ditch or bank, would be an abundant protection against cattle; and if that kind of fence would serve, the best and most durable fencing timber could be used, and such fences would be cheaper than the worst now made. But the legal requisition now existing for excluding hogs, (and even those of the smallest size,) forbids such improvement and economy in fencing, and makes necessary the close-laid rails, and 12 or 13 to each pannel, of the ordinary perishable worm fences.*

* An enterprising and intelligent New Jersey man, when on a first visit to Virginia, was induced by the very low price to buy a large farm in one of the lower counties, which he has since cultivated judiciously and profitably. He was not acquainted with, and had not thought of the provisions of the fence law of this state, until he found himself subjected to the burden. He afterwards declared that he would cheerfully pay as much more as the actual purchase money of his estate, if by so doing he could obtain for it the partial benefit of the New Jersey fence law, which differs from ours only in forbidding hogs to run at large. His estimate of what he lost by the difference was probably not

The only condition necessary for the introduction of this one amendment of the law, is a measure which nearly every good farmer of a district generally under culture, has already adopted, and which every one ought to adopt, even if having regard merely to his own interest as a feeder and fattener of hogs. This measure is to forbid his hogs ranging at large in the woods, or on waste and unenclosed lands; and to feed them in sties, and by grazing on his clover fields. There are few farmers in eastern Virginia who have not already learned that they can make no profit by keeping hogs on "woods range." In ordinary times there is so little food to be there obtained, that the corn necessary to be furnished to the hogs is more than they are worth when finally brought, half-starved or half-wild, to the pen to be fattened. And, in their then usual lean state, they will still consume as much food, before being fit for slaughter, as would nearly or quite serve to buy as much pork in market. And when there is a good crop of acorns, which is an occurrence too irregular and uncertain to be relied on, the then abundant supply causes the ranging hogs to go astray, and often become wild, so that a large proportion fall a prey to hog stealers or hog hunters—whose gratification, more than that of any others, is promoted by a "good acorn season." The writer was fully convinced long ago, by his own previous experience, that no profit or benefit was to be derived from such sources ordinarily; and though then possessing some hundreds of acres of low-lying tide-marsh and poor wood-land without his enclosure, his hogs were withdrawn from both twenty years ago, and have since had no benefit whatever from his own or other persons' waste lands. Yet, merely that other persons may enjoy the benefit of letting a few half starved and totally unprofitable hogs range upon the lands which the owner thus abandoned as worthless for this purpose, he (under the general law of the land) would have not only to yield the full use of such land to his neighbors' stock, but also to incur an expense of fencing twenty-fold as great as the profit of all the stock so ranging, to prevent them from encroaching further, and getting upon the cultivated crops. This, the former and still the general state of things, has indeed been beneficially altered in this particular case by several circumstances, and especially by the late amendment of the law, which makes certain tide-waters and other navigable waters lawful fences. The manifest benefits which have already accrued to a large portion of the agricultural community from this partial departure from the general principle of the law of enclosures, ought alone to be enough to induce the further extension of such relief.

II. *Drainage of swamps.*

The legislative policy of Virginia does not *permit* the drainage of extensive swamps, if the stream passes necessarily through several or many different properties. There is indeed no direct or designed prohibition on the statute book; but nevertheless the indirect prohibition is as effective as if expressed positively, and the restriction made valid by heavy penalties. A small swamp, or wet bottom, confined to one property, and having therein the facilities for sufficient descent and discharge for the surplus water when collected by ditches, needs nothing for its being perfectly drained and properly cultivated, but the individual proprietor's will, intelligence and industry. And, with all existing deficiencies of their proprietors, most of such lands have already been, or soon will be, drained and put under grass or grain crops. So far the silence of the law can do no harm, and nothing is required of its action. But for the greater part, the drainage of such lands requires the agreement and co operation of several, and, in some cases, of many individuals; and the want of either the will or the ability by any one proprietor operates as a complete bar to the procedure of all. The greater the extent of the swamp, (as on Blackwater and Chickahominy rivers, and many other long and swampy streams,) and the greater the nuisance its continuance forms to public as well as private interests, and the greater the number of proprietors, so will be greater the impediments to (or rather the more certain the impossibility of) any combined and general action for drainage. Indeed, if all who are free-agents among the proprietors were anxious to drain, and were perfectly agreed as to the general plan of operations, yet if there were but a single orphan's property, in possession or reversion, or widow's dower or life-right, in the swamp lands, it would effectually serve to stay all procedure for the improvement; unless indeed (which can never be expected) some one or a few of the proprietors were willing to construct and maintain the whole general work of drainage, for the equal gain of others who would pay nothing towards the object. Indeed, even this excessive degree of liberality would not always remove the legal and effective obstacles to such drainage. For some one proprietor may be so stupid or perverse, or so influenced by some peculiar motive or interest, as to be opposed to the drainage in view. And such person, even if owning but a strip of ten yards width across the course for the main drain, may effectually forbid its being cut; or, still worse, may close it after its being opened and in useful operation, and thus destroy all the benefits before achieved for the lands above.* Under

too large; and his was not a case of very unusual hardship in this respect. Very many individual farmers pay more annually for the keeping up of totally useless fences, than the whole clear income of their farms.

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* This supposed case is not imaginary or unprecedented. We are well assured of the truth of the following facts. The land of a farmer, A, in lower Virginia was penetrated by an extensive flat swamp, of which the lower extremity, and natural outlet, was in the land of his neighbor B. As there was no hope that the latter would aid in it as a joint undertaking, A agreed to do the whole work of making a general main drain, at his sole expense, for the benefit of both proprietors. The work was executed, and would have operated to drain both farms, and free them from the heavy burden before imposed by the nuisance of the swamp. All that was required and expected of B was to keep open the drain, after its being thus constructed for him gratuitously, and to let his lower part of it

such circumstances it is not to be wondered at that many thousands (perhaps some hundreds of thousands) of acres of the most fertile lands in lower Virginia still remain, (and ever must remain, while the law remains unchanged,) not only utterly worthless, but a nuisance to agriculture, and a wide-spread source of annual disease and deaths. And the evil condition and effects of these swamps have been becoming worse and worse ever since the first settlement of the country, and will continue to become worse, until the proper remedy is afforded.

In their original and natural state, the waters of such streams as the Blackwater and the upper Chickahominy, &c., which form wide swamps by their obstruction and overflow, must have had much deeper channels and lower levels than latterly and now. Except the rare falling of trees by their natural death and decay, or the construction of dams by beavers, there was nothing to obstruct the passage of the streams. But since the settlement of the country, the obstructions are increased and heightened every year, and the low lands thereby are kept more and longer under the inundations, and the nuisance of the swamp in every way increased, but more especially in the injurious effects of its exhalations on health. The large trees on the margins of the streams are cut down for timber, and their tops most frequently fall into or across the bed of the sluggish stream; and these tops, catching the floating leaves and mud, soon form dams which raise the water and compel it to spread over the adjacent level ground, and to seek new passages through the swamp. Thus it may be inferred that by such repeated obstructions the surfaces of these swamp lands are now much higher than formerly, and yet the waters are still higher in comparison to the land, and more frequently serving to inundate. The trunks of fallen trees are soon covered by water, or mud; and, being kept constantly wet, do not rot for many years. The trunks of cypress trees thus covered remain unrotted for hundreds, and perhaps thousands of years.

The obvious and effectual mode of draining such swamps, is to begin at the lowest occurring obstructions, and cut a passage of suitable width and depth through them from the clear and open outlet of the main stream, through the middle of the swamp to its head, or to the highest point of the land to be drained, taking for the route the lowest, shortest, or otherwise best course to discharge the floods, and not the mere dividing lines of opposite estates. This being done, and the passage merely being kept open, (and for that it would usually be only necesary to refrain from forming new obstructions,) the stream would be generally, if not always, kept within its new channel, (and which would indeed be deepened by the passage of the water,) the land would rarely be overflowed, and the main object of the joint and general operation would have been effected. Each individual proprietor could then certainly and cheaply complete the draining of his own share of the swamp land, by opening smaller drains, and emptying them into the deep and sufficient outlet furnished by the great main drain passing through or along side of his lowest ground. And thus, it is confidently believed, there might be drained an immense body of the most fertile lands at an expense less than one-tenth of the available value of the lands when so improved—and perhaps even less than the cost of the evil now caused by the present existence of these great nuisances.

To reach this great and beneficial end, it is necessary that a law should be enacted to authorize the execution of general schemes of drainage, and to require of all proprietors (under proper safeguards and restrictions,) to contribute to the execution of works manifestly for the benefit of each one and of all. The difficulties which might appear to oppose such beneficial legislation are as nothing in comparison to the benefits to be obtained; and if the great object were really and earnestly desired, the means would be readily found.

The degree and continuance of health and the duration of healthy or useful life, have perhaps never been estimated in pecuniary value, and are not at all suited to be so estimated with any approach to accuracy. Yet it cannot be doubted, that if thus estimated, the bare pecuniary loss to the residents of lower Virginia and to the commonwealth, caused by the diseases from malaria alone, would be of enormous annual amount. I speak not of the pain and unhappiness produced—but merely of the loss of labor of the sick and the infirm from sickness, and of the prematurely dead—of the expenditures thereby incurred—of the general and pervading benumbing and enfeebling influence of malaria on mind and body—and of the very great depreciation of all values in a region regularly so afflicted. And if the cessation of wrong legislation, or the substitution of right and wise legislation, could serve to prevent even a small proportion of the prevalent diseases of lower Virginia, it would be an incalculable gain of pecuniary agricultural value to the people, and an important gain to the state treasury, from the great increase of labor and its products, and of productive agricultural capital in general.

The statements above go to show that the great object of preserving health, which our legal policy has never aimed to aid by any permanent or judicious regulations, might be greatly forwarded by the same legal measures which would permit and induce the reclaiming of the swamps. For it is not necessary to prove the universally admitted proposition, that all swamps and swampy lands are more or less productive of unhealthy exhalations or malaria, and therefore injurious to health. But this one branch of the evil, however important a subject for the remedial action of government, is far less so than the next which

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serve as an outlet for the discharge of the water from the upper part. But A had not supposed it possible that his neighbor could fail to perform this implied obligation, and took no guaranty for the performance. Subsequently, for some reason or motive unnecessary here to investigate, B closed the main ditch at his upper boundary, retaining its draining benefit for his own ground, and leaving the land of A in as bad condition as before he began his gratuitous and fruitless labors. The estate of the latter has since remained, as before, of less than half its proper value, and the residents regular sufferers from autumnal diseases.

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will now be presented for consideration, and which has been entirely created and is maintained by legislation, and which may be generally removed or greatly mitigated, to the advantage of all parties concerned, merely by different legislation. The great political sin which continues the nuisances of unhealthy swamps is one of the legislative *omission* merely. But the still greater evil, health destroying mill-ponds, which will be next presented, is a sin of legislative *commission* in all respects.

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NOTES ON THE SANDY POINT ESTATE. NO. VI.

To the Editor of the Farmers' Register.

Sandy Point, Nov. 26, 1842.

In my last communication to the Register a statement was made of the quantities of wheat sown on this estate in fall of 1841. Throughout the remarkably mild winter which followed, this crop maintained a very promising appearance until the last week in March, when a succession of frosts for five or six nights caused it to assume a very yellow appearance, with the tops of the leaves of the larger proportion of it entirely killed. By the 8th of April its appearance was greatly improved; on the 10th, Hessian fly was first observed amongst the earliest sown wheat, and on portions of that sown in November on corn ground; and by the 19th, the wheat on fallow land, sown between the 1st and 10th of October, exhibited evident symptoms of injury from this pest; by the first of May the portion of the crop was reduced in consequence fully one-half. All the other portions of the crop had by this time improved most gratifyingly. And this appearance was fully and improvingly maintained throughout the residue of its growth; on the 30th of May amongst the small portion of rock wheat sown, smut was very general, as also indications of rust. I may add here that the result of the small experiment made here of this variety of wheat was a failure. On the 3d of June, spots of rust were observable throughout much of the crop; and by the 8th had extended over almost the entire breadth of white turkey wheat. Amongst the purple straw variety, its progress was much slower, though of sufficient extent to cause considerable and just alarm. One lot of 20 acres of this variety of wheat, sown after corn, having a heavy growth, was entirely ruined. This disease once in a wheat crop, no limits can be set to its fearful ravages, nor any estimate formed as to the probable result of a crop into which it has entered, until subjected to measurement. It was hoped here that as this disease did not generally attack the crop until it had been nearly matured, that the injury would have been slight, the result however was the reverse; its progress after the commencement of harvest was rapid, and it did appear to me that the grain was even injured after being shocked. Reaping was begun on the 16th and finished on the 28th of June, and proved to be a most unpropitious season for harvest operations. During the entire time occupied, only three days occurred in which rain did not fall. Rust made frightful progress, and from the difficulty in getting the wheat dried, the entire loss of a large portion of the crop was oftener than once anticipated, the labor of harvesting was greatly increased, and much time unavoidably lost. The actual time engaged in *reaping* amounted to only 6½ days out of the 13 during which harvest operations were protracted. In efforts to save the wheat, much of it was rather prematurely put into shock; the consequence was a very large proportion of these had again to be pulled down, sheaves untied, and the wheat spread out. In many instances this pulling down and re-opening had to be repeated at a heavy expense of labor and vexatious loss of time; nor was the whole considered in a safe condition until the 14th of July, during which time daily examinations had to be made and shocks pulled down. A great many of these became mouldy, straw much injured, and the grain also doubtless nothing benefited. The entire number of shocks amounted to 3942. Thrashing of the crop was begun on the 25th of July, and finished on the 9th of September; during which period much rain again fell—the cause not only of much loss of time, but of injury to the wheat from sprouting in the shock. In this respect, however, the loss sustained was much less than from the unfavorable condition of the weather, generally, there was reason to have anticipated.

From what has been stated above it is almost superfluous for me to say that the results of the entire crop were any thing but satisfactory, being under, rather than over, two-thirds of what, from the generally good growth of straw, and at one time promising appearance of the greater portion of the crop, might have been reasonably expected. Deliveries of the grain have not yet been completed, nor the exact quantities ascertained. The yield of the purple straw variety will average about eight bushels for one bushel sown; that from the white turkey little if any above four for one. Though the purple straw variety suffered much from rust, it suffered little in *comparison* to that of the white turkey, which was also the first to be so affected, though of a less dense and heavy growth, the same results have been experienced for the past two or three years. The sowing of that variety is for the present at least abandoned. Of the wheat (purple straw) sown on oat and pea fallow, side by side, on soil of equal quality, that on pea fallow yielded, as nearly as could be judged by the eye, not less than one-fourth more than that sown on the oat fallow, and was also a much plumper and heavier looking grain. On the oat fallow, in the beginning of May, nearly every plant of wheat was found to be affected by Hessian fly, while on the pea fallow scarcely any could be detected, though only divided by a furrow. Rust also prevailed more on the oat than the pea fallow, though the growth of straw was much the heaviest on the latter. I mention the *facts*, but cannot attempt to assign any reason why the one species of fallow should be affected to a greater extent, both by Hessian fly and rust, than the other. Clover was sown on portions of both these fallows on which marl had been applied previous to sowing the wheat. So far as could be observed, the seed made an equally good start on both; but, when the wheat was reaped, the stand of clover on the oat fallow was greatly superior to that on the pea; by the end of July that on the pea fallow had much improved, and was apparently in every respect equal to that on the

oat fallow—both of which were good. During the protracted drought which prevailed from the middle of September and throughout October, clover on the oat fallow suffered very little injury, while the stand of plants on the pea fallow has been greatly reduced. The past has been a season singularly favorable for young clover; the stand of plants here, over nearly all of the ground sown, is good, and, from one portion of ground from which wheat had been reaped, quite a heavy growth of clover from seed sown the past spring was mowed for hay about the middle of September.

448 bushels of oats were sown from the middle to the 23d of March; the crop from which was generally good, but in harvesting much loss and injury was sustained from the frequent rains. In value as chopped food they were reduced probably not less than one-third.

On the 27th and 28th of May 100 bushels of cow and 16 bushels of black-eyed peas were sown broadcast as a fallow crop for wheat. The season proved unfavorable for this crop—the grass, in consequence of the continued rains, nearly smothered the growth of peas in their early stages; they subsequently, however, much improved, and a tolerable heavy growth of vines were ploughed under. A very small proportion of peas from these vines ripened. I suppose if every pea could have been collected, the whole would not have amounted to the quantity of seed originally sown. This presents an objection to this crop, as it is extremely difficult to procure seed at a reasonable or even at any price; and without detracting from or materially injuring their value as a fertilizer, the vines ought to yield a supply of seed wherewith to continue their use. The season has, however, been an exception.

The corn crop of this season covers an area of 615 acres, planted from the 25th to the 28th of April inclusive. Corn started well, though considerable difficulty again occurred in getting a good and regular stand of plants, from cut-worms, moles and other pests, and considerable portions of the crop subsequently suffered much from the very wet season. The unusually violent storm of wind and rain which passed over this section of country on the 24th of August, (which I cannot better describe than as a rapid succession of violent gales with hurricanes by way of interlude,) inflicted on nearly all of this crop a heavy and irreparable injury. Its appearance on the following morning was truly discouraging. Large spaces appeared as if passed over by a roller; some was torn up by the roots and broken off, ears rubbed off, and blades, where any were left, whipped into shreds. In a few days its appearance became considerably improved, and hopes were entertained that less damage would be sustained than was at first feared. The crop is now being gathered, and there is but too much reason to fear that the injury sustained from these various casualties will prove very considerable. Before the storm above alluded to the general crop had a very promising appearance; much of it unfortunately was so located as to be fully exposed to its utmost violence.

Since the beginning of the present year, 28,240 bushels of marl, 17,040 bushels of oyster shell lime, and 7000 bushels of stone lime from Pennsylvania have been applied—one half the quantity of marl and all of the oyster shell lime previous to planting corn, and the other half of the above quantity of marl and all of the stone lime on land fallowed for wheat this fall. Marl was applied at the rate of from 175 to 200 bushels, oyster shell lime from 70 to 75 bushels, and the stone lime from 40 to 50 bushels per acre. From two to three acres of land, formerly very wet, and containing a very large proportion of inert vegetable matter, received at the rate of 100 bushels of stone lime per acre. The whole application from the beginning of the year up to the present time extended over a surface of 525 acres, and was limited only by the difficulty of procuring further supplies. After erecting the kilns of oyster shells for burning, the number of bushels of shells in the aggregate was ascertained as accurately as possible by calculating their cubic contents. The lime after burning, and before being slaked, was measured out in boxes made to hold one bushel, and the result as then presented was a return of 12½ bushels of unslaked lime for every 18 bushels of shells. This was a result which I did not anticipate, for until I had seen some remarks made by you in the Register, that 18 bushels of shells would only yield 14 bushels of lime, I had supposed a bushel of shells would have yielded at least an equal quantity of lime. This falling off adds much to the expense of this material for furnishing the desirable calcareous ingredient to the soil. The above quantity of shells was here carted to the near vicinity of wood suitable for the burning of them, a distance of from 1½ to 2 miles, and consequently proved a very expensive application. If the results of the application of the northern stone lime should prove as beneficial as has the application of marl and oyster shell lime hitherto, and can be procured at a reasonable price, say from 7 to 8 cents per bushel, it will prove by far the cheapest application, especially on farms located on the river where it has to be carted to considerable distances. The above stone lime contained, I believe, upwards of 31 per cent. of magnesia. I have formerly known magnesian lime used with advantage, though never containing so large a proportion of that ingredient; and from the general objections entertained against the use of this kind of lime, (magnesia having been supposed injurious to soils,) doubts were entertained as to the propriety of using it to so large an extent. The assurance, however, which you have given, that to this same quality of lime are the farmers in the most highly improved districts of Pennsylvania indebted for the great improvements made on their lands, has operated to remove all doubts on this head as to its utility.

From the end of January to the end of April 2620 loads of manure from the stable yards and cattle pens were hauled out and applied as a top-dressing, chiefly on clover. The above quantity of manure was exclusive of a very large bulk of wheat straw applied in the same way over a surface of upwards of 50 acres, thickly covered; the benefits from which were very marked and gratifying. Nearly all of the straw covered land that was fallowed for wheat this fall, as also a considerable proportion of that covered with manure from the yards, &c. From the drought which prevailed during the greater portion of the following season, not a little difficulty was experienced from the very generally dry state of the ground.

On that portion which had been covered with straw no such difficulty was experienced, it retaining sufficient moisture to render ploughing easy; while on soil of similar texture, and, in every respect, the covering of straw excepted, the same was hard, dry, and difficult to plough.

In the first number of "Notes on Sandy Point estate," reference was made to the then general inferiority of the stock of cattle, sheep and hogs. The introduction of the Durham breed of cattle is, from present appearances, likely to effect here a desirable improvement in this species of stock, though as yet there has not been sufficient time to properly test their value. Some of the raising stock from a Durham bull, out of the common breed of cows, are looking very likely. The stalling of oxen used for labor is here being so far attended with much benefit and improvement—from 76 the number has been reduced to 44; and, so soon as some young animals are old enough for work, their numbers will be again increased to 48, and which it is now believed will be sufficient for the operations on the estate, for which their labor is required. In other words, 48 oxen will, under the improved arrangements which Mr. Bolling has made for their more comfortable shelter and accomodation, feeding and the working of only young and efficient animals, do all the work formerly requiring from 76 to 80. We are yet under the necessity of working several oxen which are much too aged, and consequently not as efficient as would be desirable, but which evil will be remedied, and in future avoided, as speedily as young animals can be raised to supply their place.

A ram from the flock of John A. Selden, esq., of Westover in this county, a cross I believe of the Leicester and broad-tail breed of sheep, and when received was, for his age, one of the finest sheep I have yet seen in this country, has been introduced here, and whose lambs, out of the common and inferior variety of ewes, have exhibited a very decided improvement.

With a view to improve the stock of hogs on this estate, the Berkshires were introduced. As yet the realizing of the benefits anticipated is very doubtful. The pure Berkshires, or what was got as such, whether their tails had the genuine twist, or whether they had the requisite number of white hairs, and these on the proper and exact spots, for the real "Simon Pures" of this much cracked up breed, I do not know. Certain it is, that, with advantages greatly superior to those accorded to our common stock of hogs, the attempt to raise them has been a failure; they proved small, very indifferent breeders, bringing from two to five pigs at a litter, and these, "like angel's visits, few and far between." One sow, a likely looking animal, has, with superior advantages, not produced a litter in twelve months. These are now consigned to the fattening pen as a hopeless stock. Shoats, a cross from the Berkshire boar with our common sows, are much more likely than the pure breed, though even they do not now present that degree of improvement that was at one time anticipated. A boar of what is termed the "Improved Skinner" breed has been introduced to sows the progeny of the common Virginia hog and Berkshire boar. Whether any further improvement may thus be effected is yet uncertain. Steps are now being taken for the better accommodation and more economical feeding of these animals, with hopes that their improvement may thereby be accelerated.

A. NICOL.

RECENT AND EXTENSIVE MARLING IN SOUTH CAROLINA.

Communicated for the Farmers' Register.

Columbia S. C. Nov. 30, 1842.

Dear sir—It affords me great pleasure to comply with your request, to furnish you with a statement of my marling operations during the first year, and the result of them so far as it has been ascertained.

I commenced in November last to marl my plantation at Silver Bluff, on Savannah river. There is no marl on the place. I procured it from Shell Bluff on the same river, and had to boat it 12 miles up the stream. It requires eleven prime hands to man the boat I use, and when the river is not too high they make two trips a week, loading and unloading themselves. They bring about 1100 bushels at a load. The marl is landed at a spot below high water mark, and during the whole crop season two other hands and two carts are constantly engaged in hauling it to a place of security on the top of the bluff. At other times it is hauled directly from the landing to the fields. There are however 13 hands and 2 mules lost to the crop. My boat, which is a common pole boat, was built chiefly by my own people, and cost me about $600, including their labor. There have been incidental expenses to the amount of about $200 this year. During the year ending on the 8th of November, there were 85 trips made and about 93,000 bushels brought up. I think I can safely calculate on bringing up 100,000 bushels per annum hereafter, with the same force. I mention these facts that every one may form his own estimate of the cost of procuring marl under similar circumstances. My calculation is that it costs me about 2 cents a bushel delivered on my bluff. To one having marl on his own premises nearly the whole of this expense would be saved. I am enabled, by omitting to open new land, to haul out and spread this marl, without interfering with other plantation work, or lessening the number of acres planted per hand. In hauling out I have not been able to do as much as they do in Virginia. Mr. Ruffin, the author of the marling system, hauled 24 loads of 5¾ bushels with each cart per day a distance of 347 yards; I have done but little over half as well. I use mules however, and land being level carried 6¼ bushels at a load. I found the mules could not stand trotting back with the empty cart. The marl weighs about 105 lbs. per bushel. My land was laid off in squares, so many to an acre and a load dropped in each square. It was spread by hand; each negro taking his square, and carrying his marl on a board or in a small tray. A prime fellow can spread an acre in a day. But it is a hard task, and counting the gang round I have not averaged over half an acre for each worker. The marl spreads best when damp. It will then yield to the hand, and lumps are in general easily crushed.

Shell Bluff is a bold cliff on Savannah river, over 200 feet high and in some places more than 100 feet perpendicular. Professor Vanuxem, who

examined it some years ago (see Farmers' Register, vol. vii. p. 70, and also vol. x. p. 487) discovered 14 varieties of marl, varying in quality from 37.2 to 93.4 per cent. of carbonate of lime. In using the marl I have excluded the inferior as much as possible, and have not found the very best in any great quantity. I tested the quantity of carbonate of lime in one specimen taken at random from each boat load brought up this summer, and found the average of 34 loads to be 62.8 per cent. varying from 51 to 77. In every specimen there was a small proportion of oxide of iron and clay and sand, usually in about equal quantities. There were, no doubt, other component parts which I did not ascertain; but I satisfied myself that there was neither gypsum nor magnesia. The marl presents various appearances, being in color, white, brown, olive, yellow and violet, and in consistency from sand to soft stone. Some of it appears to be a concretion of shells, from a size scarcely visible to the naked eye to an inch in diameter. There is no hard limestone, and it is doubtful whether any of the marl here will make lime, though it is an excellent cement. Much of that which I have used has been cut from the face of the cliff with pick-axes. It falls down sometimes in fine grains, sometimes in masses. At every handling it breaks up finer, and exposure to the air assists disintegration. I do not burn or pound it, or use any preparation whatever, but spread it as I get it. Where it was spread last winter, an observer would readily discover it, and lumps as large as an egg, and occasionally much larger, are to be seen. A mere passer by, however, would not notice that the land had been marled. At every working it is more and more mixed with the soil. But I imagine it will be several years before it is completely combined with it, and until then the full effect of this marl cannot be known. A difference was apparent in this crop between the effects of that spread early in February and that spread in the latter part of April.

By the 22d of April last, I had marled 175 acres at the rate of 200 bushels to the acre. Of these I planted 50 acres in corn on the 17th March, 50 acres in cotton on the 10th April, and 75 acres in cotton on the 22d April. These three cuts are in the same field, and adjoining, being separated only by turn-rows, yet the soils vary considerably.

In the corn, I laid off 4 separate acres along the turn-row, as nearly equal in quality as possible. The one supposed to be the best was left without marl. The others were marled with one, two and three hundred bushels respectively. It was all of the same boat load, and contained 54 per cent. of carbonate of lime. This land has been in cultivation more than one hundred years. I have planted it myself 11 of the last 12 years, and sowed it in oats the other year. I have given it three light coats of manure, the last in 1839. It is a light, gray, sandy soil, of which the following was the analysis before marling, viz.

Water lost at 300°	2 per cent.
Vegetable matter	3
Silica	80
Alumina	11
Oxide of iron	2
Loss	2
	——100

This cut was in cotton last year, and my expectation was that with common seasons it would produce 12 bushels of corn per acre. And had I not kept the unmarled acre as a test, I should have set down all over that quantity to the credit of the marl. The corn came up badly, and suffered by the birds. The four experimental acres were cultivated precisely as the rest of the cut, and were distinguished only by the posts which marked the corners of each acre. From the first however the marled corn exhibited a different appearance. It was stouter and of a much deeper color. As the season advanced, the difference became greater. The marled corn was as dark a green as swamp corn usually is. The fodder was pulled on the 3d August, and after hanging two days and a half on the stalk in dry and rather windy weather, weighed as follows:

		Increase.	Per cent.
Unmarled acre	250 lbs		
Marled, at 100 bushels	285 "	35 lbs.	14
" " 200 "	314 "	64 "	25.6
" " 300 "	261 "	11 "	4.4

The corn was gathered on the 24th October, being thoroughly dry and having shrunk as much as it would in the field. There appeared to be little or no difference in point of soundness. It was shucked clean and measured in a barrel. The unmarled corn shelled out 2 quarts less to the barrel than the marled. The following was the result:

		Increase.	Per cent.
Unmarled acre	17 bush.		
Marled, at 100 bushels	21 "	4	23.5
" " 200 "	21 "	4	23.5
" " 300 "	18½ "	1½	8.8

From this it would appear that 100 bushels of marl was as efficacious as 200, and perhaps in such land as this such may be the fact. It appears also probable that 300 bushels to the acre is too much. I ought however to state that this last acre had a slight sink in the centre, and that the slopes around it are much thinner than the average land. These constitute about one-fifth of the acre, and were evidently injured by the marl. It was a bad selection for the heaviest marling; but at the time it was made I did not suppose, judging by the rates at which they marled in Virginia, that 300 bushels would injure any land. My fear now is that 200 bushels may prove too much for soil like this; and I have accordingly determined to put only 150 bushels on the acre hereafter, until I see its further effects. This has been a remarkably productive season for corn. I think the unmarled acre in this cut made at least 5 bushels more than it would have done of an average year. I presume the marled acres have done so likewise. But whether it would be fair to attribute any of the 4 bushels increased to the peculiarity of the season operating on the marl I am wholly unable to decide. Supposing the increase from the season to be the same on the marled and unmarled land, and deducting 5 bushels from the produce of each acre there will be 33⅓ per cent. in favor of the ten best marled acres. This however is all conjecture. The average per acre of this whole cut was 18 bushels. The measurement of all but

the experimental acres was made however by wagon loads according to the usual plantation estimate, in which there is liberal allowance for shrinking, &c. Had the whole been measured in the same manner as the experimental acres were, the produce would have appeared greater. I have had this cut planted in corn once before, but having been absent the whole year, no account of it was preserved, and I do not know what it produced.

I selected also and laid off separately 4 acres of cotton along the turn-row of the 75 acre cut of cotton. At the time I thought them nearly equal in quality, and the one supposed to be the best of these was left unmarled, and 1, 2 and 300 bushels of marl spread upon the other three. It turned out however that the acre with 100 bushels of marl was inferior to the average of the cut, and that with the 200 bushels about equal to it, while the other two were far superior. I was deceived by the stalks grown the year before. The two first named acres being somewhat rolling, and the year a wet one, they produced as good cotton as the other two which were flat. The unmarled acre was not much if any superior to the one marled with 300 bushels, save that there was a spot where fodder stacks had stood in 1838-9, which produced nearly double the cotton of any other spot of the same size in either acre, and added probably 30 lbs. to the amount gathered from that acre. The marl on these acres contained, like that on the corn cut, an average of 54 per cent. of carbonate of lime. This land is of the kind commonly known as *mulatto* soil, and was cleared at least as early as the corn cut. It was certainly planted by the Indians in 1740. The following was the analysis of it before marling, for which, as well as for the analysis of the corn cut, I am indebted to the kindness of Prof. Ellet:

Water at 300°	3
Vegetable matter	4.5
Silica	74
Alumina	14 5
Oxide of iron	4

This cut was not planted until the 22d April, because it could not be marled before. A dry spell occurring immediately after, at the end of two weeks very little cotton had come up except in the unmarled acre in which there was about half a stand. My overseer becoming alarmed in my absence replanted the whole, and threw out the old seed wherever it had not come up. This was done on the 6th May, so that the crop of this cut dates from that period, which is at least a month later than I should have preferred. For my experience is that early cotton, like early corn, is almost always the best. I consider the two weeks start which one half the unmarled acre obtained in this instance as of considerable consequence to it. These early stalks could be distinguished until the bolls began to open. The difference between the marled and unmarled cotton was as obvious as it was in the corn. The leaf too appeared broader and the stalk stouter from the first. The following was the production of these four acres. I state the production of all, though that of the 1 and 200 bushels acres ought not to be compared with that of the other two, on account of the relative inferiority of the soil.

The unmarled acre	1111 lbs.	in the seed.
Marled do at 100 bushels,	846 "	"
" " at 200 "	1003 "	"
" " at 300 "	1318 "	"

The difference between the unmarled acre and that with 300 bushels of marl was 17.7 per cent. in favor of the latter. It would have been greater perhaps any other year than this, which has been almost as favorable for cotton as corn. The average production of the whole 75 acres was 966 lbs. per acre. I have had this cut in cotton 10 of the last twelve years; in corn 1, and in oats 1, and the following is a statement of its production of cotton for 6 of the 10 years; that of the other years not having been preserved.

1833	average pr. acre	in seed	731 lbs.	manured lightly.
1834	"	"	784 "	
1835	"	"	951 "	manured lightly.
1836	"	"	451 "	
1840	"	"	497 "	
1841	"	"	500 "	manured.
1842	"	"	966 "	marled.

The other 50 acre cut of marled land was planted in cotton on the 10th April. It came up in good time and was a fine stand. This is also a light gray soil, with less clay than the mulatto land, and less sand than the corn cut. It is probably as old as either, and has been cultivated in much the same way. Although planted 10 days later than some other fields, and after all of them except the 75 acre cut, it soon appeared to be the oldest cotton and certainly matured the earliest of any. Immediately after the cold weather, about the 1st August, the rust commenced in it, and by the 20th of that month it had the appearance of a field after frost. Forms, small bolls, and even the leaves dropped. Most persons who saw it thought it had been cut off one half. I think myself it suffered to the extent of one fourth at least. But I have made on this cut this year 840 lbs. of seed cotton, which is nearly 50 per cent. more than I ever made on it before. The following is the average of its production for 4 other years.

1833	average pr	acre	in seed	569 lbs.	manured
1834	"	"	"	435 "	
1840	"	"	"	368 "	
1841	"	"	"	366 "	manured lightly.
1842	"	"	"	840 "	marled.

I think the injury from the rust nearly or quite equal to the benefit derived from the favorable season. And that the increase from the marl was greater on this cut than any other, because the earliest marled and most seasonably planted. The rust here was more injurious than in any other field, and I might have attributed it to the marl, but that the 75 acre cut also marled suffered least of all. I am inclined to think that the most advanced cotton was most affected, and the youngest least; and that marl had no influence one way or the other. It is worthy of remark, that while all my other cotton suffered from lice and the worm both, neither made their appearance on the marled land.

I have troubled you with this lengthy detail of my operations, because this being the first serious experiment with marl in South Carolina (that I know of) it may be interesting to those who have this earth within their reach, to know the particulars. From the facts I have stated, each one can form his opinion on nearly as good data as I can my own. I can only add that my expectations for the first year have been fully an-

swered. I did not calculate on any of those magical results which agricultural experimenters so olien look for, and so seldom realize to the full extent. I regard an increase of 20 per cent. as a very handsome return, and if it only does as well another year, I shall at all events be repaid for my labor even if the beneficial effect of the marl ceases then. But the experience of all who have used it is, that it continues to improve the soil every year, until thoroughly disintegrated and combined with it; and that with proper culture it never declines from its maximum. Under these circumstances, and with these hopes, I shall continue myself to prosecute the business vigorously during the summer. I have hauled marl over 160 acres, and have now at my landing enough to cover 300 acres more. My great regret is that I did not engage in the business sooner. I have long known Shell Bluff, and for some years had heard of Mr. Ruffin's successful introduction of marl into the culture of Virginia. But I had not read his 'Essay on Calcareous Manures,' nor examined Shell Bluff, until the summer of 1841. The idea of obtaining marl from that spot was first suggested to me by my friend Mr. Dickenson, of Georgia; and after a careful perusal of Mr. Ruffin's Essay, and an analysis of the varieties of marl there, I determined to try the experiment. I have during the course of it received much encouragement and valuable practical information from Mr. Ruffin himself, to whom in common with all other beneficia ies of this inestimable treasure, I owe a debt of gratitude which cannot be easily cancelled. I am, my dear sir,

With great regard and esteem,
Your obedient servant,
J. H. Hammond.

Hon. Whitemarsh B. Seabrook,
President of the State Agr. Soc.

THE GARDEN SNAIL.

From the Southern Agriculturist.

There are two very different species of snail in the gardens in Charleston. They are both of foreign origin, and are both considered very trou blesome.

The large round snail has long been known in the gardens; it is the *Helix aspersa*, a very common and extensively diffused species in Europe. It is said to have been imported by some of our French ancestors, as an article of food in certain cases of disease. It is much more probable that we are indebted for its introduction to the ballast from European vessels.*

The other species of snail is much the most formidable enemy in our gardens, and is also a foreigner—it is the "*Bulimus decollatus*," from the south of France, and described in this country by Mr. Say, as the "*Bulimus mutilatus*," from specimens sent to him by Mr. Stephen Elliott.

It is of much more recent importation than the "*Helix aspersa*," and is thought to destroy that snail. In gardens in which the round snail was once very abundant, not an individual can now be found—but the long snail has become extremely numerous. It is difficult to date the introduction of such animals, but about the year 1813, this Bulimus made its appearance in some of the gardens in the lower part of Meeting-street, and has since been gradually spreading over the whole city.

It is gathered by gardeners, and frequently thrown alive into the river; the shells are therefore occasionally found on the neighboring shores, particularly on the beach at Sullivan's Island. Individuals not unfrequently reach the shore alive, and with strength enough to seek the herbage for food and shelter—and thus they may be propagated in various directions around the city.

Within the last two years, they have been observed in a garden on Sullivan's Island, and will probably extend their depredations there, as they have done in the city.

It is not known if they have as yet been found beyond the city, except in the garden at Sullivan's Island. E.

Charleston, S. C., 1842.

* This supposition has been ascertained to be a fact, as the garden of a gentleman in Charleston was never troubled with any slugs, until the season after he spread small ballast in the walks, which came from Europe.

NEW HORSE SHOE.

From the United Service Gazette.

A simple but most ingenious invention has been laid before us in the shape of an improvement in the horse shoe. It is that of making that part of the shoe which is now solid, concave; by which the foot is enabled to take a grip, which with the ordinary shoe is impossible. The principle is, in fact, that of the fluted skate; and whilst the shoe is, of course, lighter than when manufactured on the usual principle, it is equivalent in slippery weather, or on wood pavement, to one that is roughed. The concavity runs entirely round the shoe, having a strong rim in front, equal in thickness to the hoof of the horse's foot, and another at the back of half that thickness. This mode of formation, whilst it involves the use of a smaller quantity of iron, and consequently less weight, gives a far greater purchase, and is much more in accordance with the nature, form, and texture of the horse's foot. By preventing the necessity of turning up the shoe behind, it places the foot in a more natural position, and thus assists in bringing into operation the frog, instead of placing it out of action, and straining all the other parts of the foot.

PUBLIC SALE OF PROVISIONS AT LIVERPOOL, UNDER THE NEW TARIFF.

From the English Farmers' Journal.

Monday, the 10th inst., was the day fixed by the New Tariff for the payment of the reduced duties on salted provisions, and in consequence public sales to a considerable extent were announced to take place on the following day in Liverpool. These sales comprised 1,512 barrels of American beef, 2,199 barrels American pork, 321 barrels American hams, 691 barrels

Canadian pork, and 35 barrels Canadian beef, which excited considerable interest and curiosity. The attendance of town and country dealers was numerous, with some gentlemen from Ireland, the latter no doubt to watch the progress of a trade threatening to interfere with that which they have enjoyed exclusively so long. It must be observed that the greater portion of the United States' meat was imported some months ago, and having been cured before it was known that there would be a change in the British duties, was not so well suited to the taste of consumers here, as doubtless they will be rendered hereafter. The meat was generally very well fed, though rather fatter than the usual run of Irish. Of the beef, on the contrary, it was observed that it was not sufficiently well fed. The hams that were sold went at 30s. 6d. to 31s. per cwt. duty paid. Prime beef sold at 38s. to 39s. per barrel, duty paid; a very old parcel went even lower. Pork went at 41s. to 46s. per barrel, duty paid. The Canadian pork realised 43s. to 46s. per barrel, duty paid; and the little Canadian beef that was offered brought 46s. to 48s. for prime; one lot prime mess 50s. per barrel, duty paid. Several parcels of American cheese were also offered, and sold at 36s. 6d. to 46s. 6d. per cwt., duty paid, for inferior to middling quality; whilst a few lots of good brought 50s. to 54s. per cwt., duty paid.—

CHEAP MARLING.

[The following is a passage from a private letter just received, and which we take the liberty of publishing, because it presents an example of one of the cheapest marling operations. Yet many thousands of acres in lower Virginia still are neglected, which may be marled as cheaply, and which but a few years ago (as was the case with this field) could not have been sold for more than $3 the acre.—Ed. F. R.]

December 8, 1842.

I am now marling from the bank which you saw when you were here, and find by your calculation of the expenses of marling in the 'Essay on Calcareous Manures' that it cost me 99 cents per acre to put on 225 bushels of marl, (containing 80 per cent. of carbonate of lime,) exclusive of the labor of spreading; and the marling of the remainder of the field of about 50 acres will not exceed $1.25. I was induced to make the calculation from reading an account of your marling on Coggins Point, the other day, and was surprised to find the difference in cost so great. My road was already open, having once been an old public road. I shall finish all my open land this winter, and some 15 or 20 acres of wood-land which I intend to clear.

FIRST LABORS OF A WORKING AGRICULTURAL SOCIETY.

The Agricultural Society of Prince George held its first stated meeting on the 10th instant. This small and unpretending society was established last spring, upon the *working plan*, and under the form of constitution and of procedure proposed at page 719, vol. ix. Farmers' Register, with the exception of a few changes of unimportant details. The result of this first meeting after commencing operations are such as to show that the plan will work in practice, (if continued as begun,) as well as it promised in theory. The society had only 26 members; and of these, in obedience to the general requisition, 18 presented at the late meeting written statements of one or more experiments, made with care, and noted accurately. It is of little importance (for the great object in view) whether these experiments, or any one of them, may exhibit any remarkable results, or such as may lead to new and valuable practices. It is enough that the members have now learned and acted upon the simple fact that any plain farmer can properly conduct agricultural experiments—and even though totally unused to writing for the public eye, can record them accurately, and well enough for the purpose. *Every* experiment so made and noted, and reported, if upon any doubtful subject, must serve to make a somewhat nearer approach to truth and knowledge; and any number of cultivators continuing for years together thus to seek truth by accurate experiments, and to bring together all the results, cannot fail to produce effects of great value to each individual, and to the community. Each person so contributing, however diffident and awkward he may have felt at first in attempting a task so totally new to him, will find the effort easy, and the labors pleasing and instructive, and profitable in reference to his general habits and procedure as a farmer, as well as for the particular lights gained by the experiments made. For a society to *merely commence* such a course of procedure is of itself effecting much; and much more may be confidently expected from each succeeding year's operations.

This society having been formed upon our recommended plan, (above referred to,) we may be pardoned for expressing something of *fatherly* feelings of gratification and partiality, in witnessing its first and useful efforts. And it would be still more gratifying to us, and appropriate in all respects, to have closed our editorial labors by publishing the report of the first experiments and labors of this society. This however is impossible

in the few pages of this volume yet to be filled, and in the few days of our editorial and public life which yet remain unfinished.

In addition to the regular duties of members, we learn that the society has taken measures to obtain an accurate statement of the lands marled and limed in the county of Prince George, such as, and more full than the report we were lately enabled to publish for the county of King William. Every such statement will be both interesting and beneficial. And if it could be made general throughout the state, by legislative authority, and the operations of each subsequent year be thereafter added, the beneficial consequences would be perhaps greater than the publication of any statistics whatever. This is one of the few measures recommended to the legislature by the Board of Agriculture; and, as it will not cost the treasury the expenditure of a dollar, there may be some hope indulged of the execution. Among the beneficial consequences of such general and accurate reports of the applications of these permanently improving measures, would be the following:

The large amount of such labor already performed would be astonishing to all; and the magnitude of the operations, and their long continuance and annual increase, would prove, more satisfactorily than any reasoning or statements of particular profitable results, the great and certain profit thence derived. The facts thus broadly and clearly displayed, and the inevitable deductions from them, would alone serve to induce marling to be commenced by very many farmers, who have, for want of information, neglected it heretofore; and would cause liming to be commenced by far greater numbers, and the mode of improvement to be introduced in perhaps 30 or more of the upper counties of Virginia, where the practice has heretofore been unknown, and may otherwise remain untried for half a century to come.

Even in the counties where great improvement and profits have already been derived from marling and liming, the emulation of each individual would be stimulated, by such reports of the operations of each, to increase his own exertions; and probably the second year's reports would show a great increase of attention and effort, even where least wanting before. None of us do, in this or any other respect, *all* that we know to be right, or that would be profitable. And the most sanguine or the most industrious and judicious marlers and limers would be thus urged to increased and profitable exertions, as well as, in a far greater degree, the more indolent, neglectful, or heretofore skeptical, to make their first efforts in this mode of improvement.

And lastly—upon any grounds whatever of estimating values that can be applied to the reports of marling and liming thus to be obtained, the magnitude of the intrinsic value of agricultural fixed capital and wealth, and of annually increasing income, would both be so enormous in amount, that nothing could so strongly show the importance of using every means for *diffusing agricultural information and knowledge*, to which cause much the larger part of these operations are altogether due. Our legislature might possibly thus learn that any sum judiciously expended in furtherance of the great end of agricultural improvement, is not lost, but is as the seed sown which will return to the commonwealth a future harvest of a hundred-fold of increase.—Ed F. R.

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FARMERS' REGISTER.

VOL. X.—NO. 12, AND SUPPLEMENT, CONTAINING

AN

ESSAY

ON

CALCAREOUS MANURES.

THIRD EDITION.

BY EDMUND RUFFIN.

PETERSBURG:

PRINTED FOR THE AUTHOR.

1842.

Entered according to act of Congress, by Edmund Ruffin, in the Clerk's Office of the District Court of the Eastern District of Virginia.

PREFACE TO THE FIRST EDITION.

The object of this essay is to investigate the peculiar features and qualities of the soils of our tide-water district, to show the causes of their general unproductiveness, and to point out means, as yet but little used, for their effectual and profitable improvement. My observations are particularly addressed to the cultivators of that part of Virginia which lies between the sea coast and the falls of the rivers, and are generally intended to be applied only within those limits. By thus confining the application of the opinions which will be maintained, it is not intended to deny the propriety of their being further extended. On the contrary, I do not doubt that they may correctly apply to all similar soils, under similar circumstances; for the operations of Nature are directed by uniform laws, and like causes must every where produce like effects. But as I shall rely for proofs on such facts as are either sufficiently well known already, or may easily be tested by any inquirer, I do not choose to extend my ground so far as to be opposed by the assertion of other facts, the truth of which can neither be established nor overthrown by any available or sufficient testimony.

The peculiar qualities of our soils have been little noticed, and the causes of those peculiarities have never been sought; and though new and valuable truths may await the first explorers of this opening for agricultural research, yet they can scarcely avoid mistakes sufficiently numerous to moderate the triumph of success. I am not blind to the difficulties of the investigation, nor to my own unfitness to overcome them; nor should I have hazarded the attempt, but for the belief that such an investigation is all-important for the improvement of our soil and agriculture, and that it was in vain to hope that it would be undertaken by those who were better qualified to do justice to the subject. I ask a deliberate hearing, and a strict scrutiny of my opinions, from those most interested in their truth. If a change, in most of our lands, from hopeless sterility to a high state of productiveness, is a vain fancy, it will be easy to discover and expose the fallacy of my views; but if these views are well founded, none deserve better the attention of farmers, and nothing can more seriously affect the future agricultural prosperity of our country. No where ought such improvements to be more highly valued, or more eagerly sought, than among us, where so many causes have concurred to reduce our products, and the prices of our lands, to the lowest state, and are yearly extending want, and its consequence, ignorance, among the cultivators and proprietors.

In pursuing this inquiry, it will be necessary to show the truth of various facts and opinions which as yet are unsupported by authority, and most of which have scarcely been noticed by agricultural writers, unless to be denied. The number of proofs that will be required, and the discursive course through which they must be reached, may probably render more obscure the reasoning of an unpractised writer. Treatises on agriculture ought to be so written as to be clearly understood, though it should be at the expense of some other requisites of good writing; and, in this respect, I shall be satisfied if I succeed in making my opinions intelligible to every reader, though many might well dispense with such particular explanations. Agricultural works are seldom considered as requiring very close attention; and therefore, to be made useful, they should be put in a shape suited to cursory and irregular reading. A truth may be clearly established —but if its important consequences cannot be regularly deduced for many pages afterwards, the premises will then probably have been forgotten, so that a very particular reference to them may be required. These considerations must serve as my apology for some repetitions—and for minute explanations and details, which some readers may deem unnecessary.

The theoretical opinions supported in this essay, together with my earliest experiments with calcareous manures, were published in the 'American Farmer,' (vol. iii., page 313,) in 1821. No reason has since induced me to retract any of the important positions then assumed. But the many imperfections in that publication, which grew out of my want of experience, made it my duty, at some

future time, to correct its errors, and supply the deficiencies of proof, from the fruits of subsequent practice and observation. With these views, this essay was commenced and finished in 1826. But the work had so grown on my hands, that instead of being of a size suitable for insertion in an agricultural journal, it would have filled a volume. The unwillingness to assume so conspicuous a position as the publication in that form would have required, and the fear that my work would be more likely to meet with neglect or censure than applause, induced me to lay it aside, and to give up all intention of publication. Since that time, the use of fossil shells as manure has greatly increased, in my own neighborhood and elsewhere, and has been attended generally with all the improvement and profit that was expected. But from paying no regard to the theory of the operation of this manure, and from not taking warning from the known errors and losses of myself as well as others, most persons have used it injudiciously, and have damaged more or less of their lands. So many disasters of this kind seemed likely to restrain the use of this valuable manure, and even to destroy its reputation, just as it was beginning rapidly to extend. This additional consideration has at last induced me to risk the publication of this essay. The experience of five more years, since it was written, has not contradicted any of the opinions then advanced—and no change has been made in the work, except in form, and by continuing the reports of experiments to the present time.

It should be remembered that my attempt to convey instruction is confined to a single means of improving our lands, and increasing our profits; and though many other operations are, from necessity, incidentally noticed, my opinions or practices on such objects are not referred to as furnishing rules for good husbandry. In using calcareous manure for the improvement of poor soils, my labors have been highly successful; but that success is not necessarily accompanied by general good management and economy. To those who know me intimately, it would be unnecessary to confess the small pretensions that I have to the character of a good farmer; but to others it may be required, for the purpose of explaining why other improvements and practices of good husbandry have not more aided, and kept pace with, the effects of my use of calcareous manures.

E. R.

Prince George county, Virginia, January 20th, 1832.

PREFACE TO SECOND EDITION.

When the first edition of this essay was published, it met with a reception far more favorable, and a demand from purchasers much greater, than the author's anticipations had reached; and it is merely in accordance with the concurrent testimony of the many agriculturists who have since expressed and published opinions on the subject, to say that the publication has already had great and valuable effects in directing attention, and inducing successful efforts, to the improvement of land by calcareous manures. Experimental knowledge on this head has probably been more than doubled within the last two years; and the narrow limits of the region within which marling had previously been confined, have been enlarged to perhaps ten-fold their former extent. Still, the circumstances now existing, however changed for the better, present a mere beginning of the immense and valuable improvements of soil, and increase of profits, that must hereafter grow out of the use of calcareous manures, *if their operation is properly understood by those who apply them.* But if used without that knowledge, their great value will certainly not be found; and indeed, they will often cause more loss than profit. It is therefore not so important to the farmers of our country at large to be convinced of the general and great value of calcareous manures—and to those in the great Atlantic tide-water region to know the newly established truth, that their beds of fossil shells furnish the best and cheapest of manures—as it is, that all should know in what manner, and by what general laws, these manures operate—how they produce benefit, and when they may be

either worthless or injurious. And this more important end, the author regrets to believe has as yet scarcely been even partially attained, by the dissemination and proper understanding of correct views of the subject. Of course it is not to be supposed that this essay has been read (if even heard of) by one in ten of the many who have been prompted by verbal information to attempt the practice it recommends; and of those who have read, and who have even expressed warm approbation of the work, it has seldom been found that their praise was discriminating, or founded upon a thorough examination of its reasoning and theoretical views, on which principally rests whatever value it may possess. For all persons who are so easily convinced, it may truly be said, that the volume embraced nothing more, and was worth no more, than would be stated in these few words—"the application of calcareous manures will be found highly improving and profitable." It is not therefore at all strange, that the attentive reading of a volume to obtain this truth, was generally deemed unnecessary.

Though the first edition of this work has been nearly exhausted, the circulation has as yet been almost confined to that small portion of the state of Virginia alone in which the mode of improvement recommended had previously been successfully commenced, or had at least attracted much attention. But this district is not better fitted to be thus improved than the remainder of the great tide-water region stretching from Long Island to Mobile—and to a great part of which calcareous manures may be cheaply applied. It is only in parts of Maryland and Virginia that many extensive and highly profitable applications of fossil shells, or marl, have been yet made. In North Carolina the value of the manure has been but lately tried; in South Carolina and Georgia, no notice of it has yet been taken, or at least has not been made known; and in Florida and Alabama, (parts of which are peculiarly suited to receive these benefits.) it is most erroneously thought that such improvements are only profitable for long settled and impoverished countries. The farmers of Pennsylvania have gone far ahead of those of Virginia in manuring with lime—and it is believed (but upon no certain testimony) that in New Jersey, use has been made of the calcareous manure which in Virginia is called marl, as well as of the *green sand*, which they even still more erroneously call by the same name. But whatever may have been the extent of their use of calcareous manures of every kind, and however great their success, it is believed that our northern brethren have been as little directed by correct views of the operation of these manures, as those of the south, who have neglected them entirely.

But though the circulation of this work will be most useful through the great tide-water region, which is so generally supplied with underlying beds of fossil shells, and so much of the soil of which especially needs such manure, still the assertion may be ventured that there is no part of the country where the views presented, *if true*, are not important to be known; and, if known, would not be highly useful to aid the improvement of soils. It is to the general theory of the constitution of fertile and barren soils, that the attention and severe scrutiny of both scientific and practical agriculturists are invited; and to the several minor points there presented, which are either altogether new, or not established by authority—such as the doctrine of acidity in soils—of the incapacity of poor and acid soils to be enriched—and of the entire absence of carbonate of lime in most of the soils of this country.

The circumstances stated above, have induced the publication of a second edition as a supplement to the 'Farmers' Register,' (and suited to be bound with either volume of that work,) which, in that form, may have the facility of distribution through the mail—and which may be offered at so low a price as to reach, as nearly as possible, that general circulation which is its author's main object.

April, 1835.

PREFACE TO THE THIRD EDITION.

The rapid progress of improvement made by the use of calcareous manures, as well as the many misdirected and less effective attempts to obtain such results, together with the acquisition of much recent and extended information on the subject, all concur in requiring the new and enlarged edition of the Essay on Calcareous Manures, which the author now offers to the agricultural public.

In the few years which have passed since the issue of the preceding edition, it is believed that the use of marl and lime, in lower Virginia, has been extended over thrice as much land as had been previously thus improved; and the previous clear income of the farmers thus fertilizing their lands has probably been already thereby increased in amount by several hundreds of thousands of dollars, and the intrinsic value of the lands raised by as many millions. These great augmentations of annual profits and of the true value of landed capital, from this single source, if they could be accurately estimated, would be seen to have produced an important item of additional revenue to the treasury of the commonwealth. And these additions of wealth to individuals and to the state, would be obvious as well as real, but for the existence of other circumstances which have operated to counteract or to disguise the proper results. The most important of such influences will be merely referred to here in the cursory manner only that the occasion permits.

In the first place—besides the deservedly very low appreciation of all lands in Virginia, founded on the smallness of their products, the market prices were formerly still more reduced by the almost universal urgent desire of proprietors to sell, that they might be enabled then to emigrate to the new and rich lands of the west. The impossibility of selling, even at the lowest valuation price, was the only thing which prevented the actual flood of emigration being so much more swelled as to leave half our lands unoccupied and waste. If purchasers had but presented themselves, fully half the farms in Prince George county (and it is presumed of many other counties) might have been bought up at a considerable deduction from the lowest estimated value; and all the sellers would have removed, with all their capital, to the western wilderness. To the then actual and regular flow of emigration from the now marling district, an effectual barrier has been opposed by the introduction of that mode of improvement. All emigration has ceased wherever by trial of this means the cultivators of the land found their labors to be richly repaid. Thus, in estimating the gains of individuals and of the state, on this score, the comparison should be made, not with the value of property and population which remained twenty years ago, but with what would have remained now, if the then existing inducements to emigration had continued to go on and to increase, as they would have done, with time.

Next—the actual increase of intrinsic value of marled lands is far from being even yet fully appreciated, because of the generally prevailing and very erroneous mode of estimating the values of the increase of permanent net income from land, (as will be made manifest in a part of this essay—) and but few even of those persons who have obtained such values by marling their lands, would estimate them at one-fourth of their true amount. The source of any *permanent net increase* of only $6 of annual income from land, adds $100 to the intrinsic value of the land. And this proposition is not the less true, and to the full extent asserted, even though the estimate of private purchasers and sellers, and of public assessors of lands, may all count for the market price but a small proportion of the increased real value.

Next—even whatever of new appreciation the foregoing influences might have permitted to be exhibited in the increased market price of lands, and still more their new real value, have been disguised, or altogether concealed, by the great and frequent fluctuations of all market prices of property, and by the general misdirections of capital and industry, all caused by the universal individual and national gambling (whether voluntary or compulsory,) at the maddening and ruinous

game of paper-money banking—to which system of delusion and fraud this otherwise most blessed country and fortunate people are indebted for so much of disaster, loss, and, still worse, of wide-spread corruption of habits and morals. The enormous apparent and illusory profits promised by this system, and by the stock-jobbers who alone have fattened upon the facilities it offered for fraud and plunder, served powerfully to depress the market price of lands, and to discourage agricultural investments and pursuits. For, whatever actual profits the improvement and cultivation of the soil might offer to reward the care and labor of the proprietor, the stocks of various corporations, falsely appreciated by means of a bloated paper currency and by the arts of stockjobbers, *promised* much higher profits, without requiring either care, labor or risk. Thus, the higher that fictitious dividends of profits or the false values of stocks rose, and the stronger became the inducements to make stock investments, the more the prices of lands sunk (comparatively) below their true value, because of the general disposition to convert landed capital to stock capital. But the real and solid increase of income and of wealth to individuals and to the commonwealth, caused by the permanent improvement of the soil, is not the less certain, or the less profitable, because fictitious appreciations of values, caused by the fraudulent banking system, and the consequent speculations and madness of its votaries and victims, have been both so much higher and lower, at different times, as to make the amount of actual improved values appear small in comparison, even if they were not thereby entirely concealed. But these delusive and ruinous causes of fluctuating prices and values are now fast showing their emptiness, and vanishing from view; and whenever the fraudulent paper system shall be completely exposed and entirely exploded, then both lands and paper money system will be estimated at their true value. May the consummation be speedy, complete, and final!

But even though, if properly and accurately estimated, the true value of the lands already marled and limed in Virginia has been increased to the amount of some millions of dollars, the gain is very small compared to that which yet remains ready to be obtained. Marling has not yet been extended over the hundredth part of the surface to which it may be profitably applied—and liming not to the ten-thousandth part of the lands of the state to which lime may be brought. And elsewhere, with the exception of a small part of Maryland, the beginnings of marling only have as yet been made. Nevertheless, these beginnings are the widely scattered seeds which will spring up and spread, and hereafter yield abundant harvests. In South Carolina, more especially, the use of marl has been at last commenced and is now regularly prosecuted under auspices which offer assurance that the rich resources of that state, in calcareous deposites, will not much longer be permitted to lie as dead capital, of which the value was not appreciated or known, and the existence scarcely suspected by the proprietors.

In preparing this new edition, the author has endeavored to avail himself of all recent lights, and to present a full and clear view of the general subject, as well as of all essential details. The general theoretical opinions, as presented in the earlier editions, remain unaltered, and of course the facts of former practice; but in regard to both, while preserving the same substance, the treatment has been enlarged, or the views and statements extended for better illustration and greater clearness. Whatever of other parts of the last edition could be well spared, has been omitted; and much of other additional and new matter introduced. It has been the object of the author to render the work a full and sufficient guide for the conduct of novices in marling and liming, and he trusts that he has not fallen very far short of attaining that object.

December, 1842.

AN

ESSAY

ON

CALCAREOUS MANURES.

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PART FIRST—THEORY.

CHAPTER I.

GENERAL DESCRIPTION OF EARTHS AND SOILS.

It is very necessary that we should correctly distinguish *earths* and *soils* and their many varieties; yet these terms are continually misapplied—and, even among authors of high authority, no two agree in their definitions, or modes of classification. Where such differences exist, and no one known method is so free from material imperfections as to be referred to as a common standard, it becomes necessary for every one who treats of soils to define for himself—though perhaps he is thereby adding to the general mass of confusion already existing. This necessity must be my apology for whatever is new or unauthorized in the following definitions.

The *earths* important to agriculture, and which form nearly the whole of the known globe, are only three—*silicious*, *aluminous* and *calcareous*.

Silicious earth, in its state of absolute purity, forms rock crystal. The whitest and purest sand may be considered as silicious earth in agriculture, though none is presented by nature entirely free from other ingredients. It is composed of very hard particles, not soluble in any common acid, and which cannot be made coherent by mixing with water. Any degree of coherence, or any shade of color that sand may exhibit, is owing to the presence of other substances. The solidity of the particles of sand renders them impenetrable to water, which passes between them as through a sieve. The hardness of its particles, and their loose arrangement, make sand incapable of absorbing moisture from the atmosphere, or of retaining any valuable vapor or fluid, with which it may have been in any manner supplied. Silicious earth is also quickly heated by the sun, which adds to the rapidity with which it loses moisture.

Aluminous or *argillaceous earth*, when dry, adheres to the tongue, absorbs water rapidly and abundantly, and when wet forms a tough paste, smooth and soapy to the touch. By burning, it becomes as hard as stone. Clays derive their adhesiveness from their proportion of aluminous earth. This also is white when pure, but is generally colored deeply and variously—red, yellow, or blue—by metallic substances. When drying, aluminous earth shrinks greatly, and becomes a mass of very hard lumps, of various sizes, separated by cracks and fissures, which become so many little reservoirs of standing water when filled by rains, and remain so, until the

lumps, by slowly imbibing the water, are distended enough to fill the space occupied before.

Calcareous earth, or *carbonate of lime*,* is *lime* combined with *carbonic acid*, and may be converted into pure or quick-lime by heat; and quick-lime, by exposure to the air, soon returns to its former state of calcareous earth. It forms marble, limestone, chalk, and shells, with very small admixtures of other substances. Thus the term *calcareous earth* will not be used here to include either *lime* in its pure state, or any of the numerous combinations which lime forms with the various acids, except that one combination (carbonate of lime) which is beyond comparison the most abundant throughout the world, and most important as an ingredient of soils. Pure lime attracts all acids so powerfully, that it is never presented by nature except in combination with some one of them, and generally with the carbonic acid. When this compound is thrown into any stronger acid, as the muriatic, nitric, or even common vinegar, the lime, being more powerfully attracted, unites with and is dissolved by the stronger acid, and lets go the carbonic, which escapes with effervescence in the form of air. In this manner, the carbonate of lime, or calcareous earth, may not only be easily distinguished from silicious and aluminous earth, but also from all other combinations of lime.

The foregoing definition of calcareous earth, which confines that term to the *carbonate* of lime, is certainly liable to objections, but less so than any other designation. It may at first seem absurd to consider as one of the three principal earths which compose soils, *one* only of the many combinations of lime, rather than either *pure lime* alone, or lime in *all* its combinations. One or the other of these significations is adopted by the highest authorities, when the calcareous ingredients of soils are described; and in either sense, the use of this term is more conformable with scientific arrangement, than mine. Yet much inconvenience is caused by thus applying the term calcareous earth. If applied to *lime*, it is to a substance which is never found existing naturally, and which will always be considered by most persons as the artificial product of the process of calcination, and as having no more part in the composition of natural soils, than the manures obtained from oil-cake, or pounded bones. It is equally improper to include under the same general term all the combinations of lime with the fifty or sixty various acids. Two of these compounds, the sulphate and the phosphate of lime, are known as valuable manures; but they exist naturally in soils in such minute quantities, as not to deserve to be considered as important ingredients. A subsequent part of this essay will show why the oxalate of lime is also supposed to be highly valuable as a manure, and far more abundant. Many other salts of lime are known to chemists; but their several qualities, as affecting soils, are entirely unknown—and their

* *Carbonate of lime* is the chemical name for the substance formed by the combination of *carbonic acid* with *lime*. The names of all the thousands of different substances (*neutral salts*) which are formed by the combination of each of the many acids with each of the various earths, alkalies, and metals, are formed by one uniform rule, which is as simple, and easy to be understood and remembered, as it is useful. To avoid repeated explanations in the course of this essay, the rule will now be stated by which these compounds are named. The termination of the name of the acid is changed to the syllable *ate*, and then prefixed to the particular earth, alkali, or metal with which the acid is united. With this explanation, any reader can at once understand what is meant by each of some thousands of terms, none of which might have been heard of before, and which (without this manner of being named) would be too numerous to be fixed in the most retentive memory. Thus, it will be readily understood that the *carbonate of magnesia* is a compound of the carbonic acid and magnesia—the *sulphate of lime*, a compound of sulphuric acid and lime—the *sulphate of iron*, a compound of sulphuric acid and iron—and in like manner for all other terms so formed.

quantities are too small, and their presence too rare, to require consideration. If all the numerous different combinations of lime, having perhaps as many various and unknown properties, had not been excluded by my definition of calcareous earth, continual exceptions would have been necessary, to avoid stating what was not meant. The *carbonate of lime*, to which I have confined that term, though only one of many existing combinations, yet in quantity and in importance, as an ingredient of soils, as well as a part of the known portion of the globe, very far surpasses all the others.

But even if calcareous earth, as defined and limited, is admitted to be the substance which it is proper to consider as one of the three important earths of agriculture, still there are objections to its name, which I would gladly avoid. However strictly defined, many readers will attach to terms such meanings as they had previously understood: and the word *calcareous* has been so loosely and so differently applied in common language, and in agriculture, that much confusion may attend its use. Anything "partaking of the nature of lime" is "calcareous," according to Walker's Dictionary; Lord Kames limits the term to *pure lime*;* Davy† and Sinclair‡ include under it pure lime and all its combinations; and Kirwan,‖ Rozier,¶ and Young,§ whose example I have followed, confine the name calcareous earth to the carbonate of lime. Nor can any other term be substituted without producing other difficulties. *Carbonate of lime* would be precise, and it means exactly the same chemical substance; but there are insuperable objections to the frequent use of chemical names in a work addressed to ordinary readers. Chalk, or shells, or mild lime, (or what had been quick-lime, but which, from exposure to the air, had again become carbonated,) all these are the same chemical substance; but none of these names would serve, because each would be supposed to refer to such certain form or appearance of calcareous earth, as they usually express. If I could hope to revive an obsolete term, and with some modification establish its use for this purpose, I would call this earth *calx*—and from it derive *calxing*, to signify the application of calcareous earth, in any form, as manure. A general and definite term for this operation is much wanting. Liming, marling, applying drawn ashes, or the rubbish of old buildings, chalk, or limestone gravel, all these operations are in part, and some of them entirely, that manuring that I would thus call *calxing*. But because their names are different, so are their effects generally considered—not only in those respects where differences really exist, but in those where they are precisely alike.

Calcareous earth in its different forms has been supposed to compose as much as one eighth part of the crust of the globe.** Very extensive plains in France and England are of chalk, pure enough to be nearly barren, and to prove that pure calcareous earth would be entirely so. No chalk is to be found in our country—and it is only from European authors that we can know any thing of its agricultural characters, when nearly pure, or when forming a very large proportion of the surface of the land. The whiteness of chalk repels the rays of the sun, while its loose particles permit water to pass through, as easily as sand;†† and thus calcareous earth is remarkable for possessing some of the worst qualities of both the other

* Gentleman Farmer, page 264, (2d Edin. ed.)
† Agr. Chem. page 223, (Phil. ed. of 1821.)
‡ Code of Agriculture, page 134, (Hartford ed. 1818.)
‖ Kirwan on Manures, chap. 1.
¶ "*Terres*"—Cours Complet d'Agriculture Pratique.
§ Young's Essay on Manures, chap. 3.
** Cleaveland's Mineralogy—On carbonate of lime.
†† Cours Complet d'Agriculture, etc. par l'Abbé Rozier—Art. "*Terres*."

earths, and which it serves to cure in them (as will hereafter be shown) when used as a manure.

Most of those who have applied chemistry to agriculture consider *magnesia* as one of the important earths.* Magnesia, like lime, is never found pure, but always combined with some acid, and its most general form is the carbonate of magnesia. But even in this, its usual and natural state, it exists in such very small quantities in soils, and is found so rarely, that its name seems a useless addition to the lists of the earths of agriculture. For all practical purposes, gypsum (though only another combination of lime,) would more properly be arranged as a distinct earth, or element of soils, as it is found in far greater abundance and purity, and certainly affects some soils and plants in a far more important manner than has yet been attributed to magnesia in its natural form.

Magnesia (or, more properly speaking, the carbonate of magnesia) is here treated as comparatively *unimportant* as an *agricultural earth*, because of its being rarely found, and in but inconsiderable quantities in natural soils, and being unattainable as a manure. It was not thereby intended to be asserted that magnesia would not be important as an ingredient of soil and as a manure, if it were abundant as the one, or at command for the other. From the great similarity in chemical properties of magnesia to lime, it is most probable that their action in soils is also similar. The alluvial soil of the Red-river bottom, in Arkansas, which is of the highest grade of fertility, I have found by analysis to contain between one and two per cent. of carbonate of magnesia, and two to three per cent. of carbonate of lime. The mud deposited by the floods of the Nile, and which forms the celebrated rich soil of Egypt, also contains carbonate of magnesia. (*Lyell, p.* 223, *vol. i.*) Yet most writers have deemed magnesia in soils a cause of sterility.

All the earths, when as pure as they are ever furnished by nature, are entirely barren, as might be inferred from the description of their qualities; nor would any addition of putrescent manures† enable either of the earths to support healthy vegetable life.

The mixture of the three important earths in due proportions will correct the defects of all; and with a sufficiency of putrescent animal or vegetable matter, soluble in water, a *soil* is formed, in which plants can extend their roots freely, yet be firmly supported, and derive all their needful supplies of air, water and warmth, without being oppressed by too much of either. Such is the natural surface of almost all the habitable world; and though the qualities and values of soils are as various as the proportions of their ingredients are innumerable, yet they are mostly so constituted that no one earthy ingredient is so abundant but that the texture‡ of the soil is mechanically suited to some one valuable crop; as some plants require a degree of closeness, and others of openness in the soil, which would cause other plants to decline or perish.

Soil seldom extends more than a few inches below the surface, as on the surface only are received those natural supplies of vegetable and animal matters, which are necessary to constitute soil. Valleys subject to inundation have soils brought from higher lands, and deposited by the water,

* Davy's Agricultural Chemistry, p. 110. Phila. ed. 1821.

† *Putrescent or enriching manures*, are those formed of vegetable and animal matters, capable of putrefying, and thereby furnishing soluble food to plants. Farm-yard and stable manure, and the weeds and other growth of the fields left to die and rot on them, are almost the only enriching manures that have been used as yet in this country.

‡ The *texture* of a soil means the disposition of its parts, which produces such sensible qualities as being close, adhesive, open, friable, &c.

and therefore are of much greater depth. Below the soil is the *sub-soil*, which is also a mixture of two or more earths, but usually is almost as barren as each of the unmixed or pure earths, because it contains very little putrescent matter, the only food for plants.

The qualities and value of soils depend on the proportions of their ingredients. We can easily comprehend in what manner silicious and aluminous earths, by their mixture, serve to cure the defects of each other; the open, loose, thirsty, and hot nature of sand being corrected by, and correcting in turn, the close, adhesive, and water-holding qualities of aluminous earth. This curative operation is merely mechanical; and in that manner it seems likely that calcareous earth, when in large proportions, also acts, and aids the corrective powers of both the other earths. This, however, is only supposition, as I have met with scarcely any such natural soil.

But besides the mechanical effects of calcareous earth, (which perhaps are weaker than those of the other two,) that earth has chemical powers far more effectual in altering the texture of soils, and for which a comparatively small quantity is amply sufficient. The chemical action of calcareous earth, as an ingredient of soils, will be fully treated of hereafter; it is only mentioned in this place to avoid the apparent contradiction which might be inferred, if, in a general description of calcareous earth, I had omitted all allusion to qualities that will afterwards be brought forward as all-important.

Nothing is more wanting in the science of agriculture, than a correct nomenclature of soils, by which the characters might be learned from the names; and nothing has hitherto seemed less attainable. The modes of classing and naming soils, used by scientific authors, are not only different, and opposed to each other, but each one of them is quite unfit to serve the purpose intended. As to the crowd of inferior writers, it is enough to say that their terms are not fixed by any rule, convey no precise meaning, and are worth not much more than those in common use among ourselves, and other practical cultivators, which often vary in their meaning within forty miles of distance. To enable us to judge of the fitness of the names given to soils by others, let us examine those applied by ourselves. We generally describe soils by making a mental comparison with those we are most accustomed to; and though such a description is understood well enough through a particular district, it may have quite a different meaning elsewhere. What are called *clay* or *stiff* soils, in Sussex and Southampton, would be considered *sandy* or *light* soils in Goochland—merely because almost every acre of land in the former counties is sandy, and in the latter, clays are nearly as abundant.

The conflict of definitions, and consequent confusion of terms, cannot be more plainly set forth, than by quoting from some of the highest authorities, the various and contradictory explanations of a term, *loam*, which is so common that it is used by every one who writes or speaks of soils—and which, in some one or other sense, each writer probably considered as forming a very large, if not the greatest proportion of the cultivated soils of his country, and of the world.

"*Loam* denotes any soil moderately cohesive, and more so than loose chalk. By the author of the Body of Agriculture, it is said to be *a clay mixed with sand.*" [*Kirwan on Manures—chap.* 1.]

"*Loam*, or that species of *artificial soil* into which the others are geneally brought by the course of long cultivation."—"Where a soil is moderately cohesive, less tenacious than clay, and more so than sand, it is known by the name of loam. From its frequency, there is reason to suppose that *in some cases* it might be called an "*original soil.*" [*Sinclair's Code of Agriculture—chap,* 1.]

"The word loam should be limited to soils containing at least one third of impalpable earthy matter, *copiously effervescing with acids.*" [*Davy's Agricultural Chemistry—Lecture* 4.] According to this definition by the most scientific writer and highest authority in chemical agriculture, if we except the small portion of shelly land, there is certainly not an acre of *natural loam* between the sea-coast of Virginia and the Blue Ridge mountains—and very few, if any, even in the limestone region.

"By loam is meant *any of the earths combined with decayed animal or vegetable matter.*" [*Appendix to Agr. Chem. by George Sinclair.*]

"Loam—*fat unctuous earth—marl.*" [*Johnson's Dictionary,* 8vo. *ed., and also Walker's.*]

"Loam may be considered a clay of loose or friable consistency, mixed with *mica* or isinglass, and *iron ochre.*" [*Editor of American Farmer, vol. iii., page* 320.]

It seems most proper to class and name soils according to their *predominant* earthy ingredients, by which term, I mean those ingredients which exert the greatest power, and most strongly mark the character of the soil. The predominant ingredient (in this sense,) is not always the most abundant, and frequently is the least. If the most abundant were considered the predominant ingredient, and gave its name to the soil,* then almost every one should be called silicious, as that earth is seldom equalled in quantity by all the others united. If the earthy parts of a soil were two thirds silicious, and one third of aluminous earth, the peculiar qualities of the smaller ingredient would predominate over the opposing qualities of the sand, and the mixture would be a tenacious clay. If the same soil had contained only one twentieth part of calcareous earth, that ingredient would have had more marked effects on the soil, than could have been produced by either doubling, or diminishing to half their quantity, the silicious and aluminous earths, which formed the great bulk of the soil. If soils were named according to certain proportions of their ingredients, (as proposed by Davy,†) a correct, though limited analysis of a soil would be required, before its name or character could be given; and even then the name and character would often disagree. But every farmer can know what are the most marked good or bad qualities of his soils, as shown under tillage, and those qualities can be easily traced to their predominant ingredients. By compounding a few terms, various shades of difference may be designated with sufficient precision. A few examples will be sufficient to show how all may be applied:—

A *silicious* or *sandy soil* has such a proportion of silicious earth as to show more of its peculiar properties than those of any other ingredient. It would be more or less objectionable for its looseness, heat, and want of power to retain either moisture or putrescent manure—and not in the least for toughness, liability to become hard after wet ploughing, or any other quality of aluminous earth.

In like manner, an *aluminous* or *clayey soil* would show most strongly the faults of aluminous earth, though much more than half its bulk might be of silicious earth.

The term *loam* is not essential to this plan, but it is convenient, as it will prevent the necessity of frequent compounds of other terms. It will be used for all soils formed with such proportions of sand and aluminous earth, as not to be light enough to be called sandy, nor stiff enough for clay soil. *Sandy loam* and *clayey loam* would express its two extremes—and *loamy*

* Which is the plan of the nomenclature of soils proposed by Rozier. See article "*Terres,*" Cours Complet d'Agriculture, etc. † Agr. Chem. p. 139.

sand would be still lighter than the former, and *loamy clay* stiffer than the latter.

In all compound names of soils, the last term should be considered as expressing the predominant earthy ingredient. Thus, a *sandy loamy calcareous soil* would be nearer to loam than sand, and more marked by its calcareous ingredient than either. Other ingredients of soils, besides the earths, or any accidental or rare quality affecting their character considerably, may be described with sufficient accuracy by such additional terms as these—a *ferruginous gravelly silicious loam*—or a *vegetable calcareous clay.*

CHAPTER II.

ON THE SOILS, AND STATE OF AGRICULTURE OF THE TIDE-WATER DISTRICT OF VIRGINIA.

——"During several days of our journey, no spot was seen that was not covered with a luxuriant growth of large and beautiful forest trees, except where they had been destroyed by the natives for the purpose of cultivation. The least fertile of their pasture lands, without seeding, are soon covered with grass several feet in height; and unless prevented by cultivation, a second growth of trees rapidly springs up, which, without care or attention, attain their giant size in half the time that would be expected on the best lands in England."

If the foregoing description was met with in a 'Journey through Cabul,' or some equally unknown region, no European reader would doubt but such lands were fertile in the highest degree—and many even of ourselves would receive the same impression. Yet it is no exaggerated account of the poorest natural soils in our own poor country, which are as remarkable for their producing luxuriant growths of pines, and broom grass, as for their unproductiveness in every cultivated or valuable crop. We are so accustomed to these facts, that we scarcely think of their singularity; nor of the impropriety of calling any land barren, which will produce a rapid or heavy growth of any one plant. Indeed, by the rapidity of that growth, (or the fitness of the soil for its production,) we have in some measure formed a standard of the poverty of the soil.

With some exceptions to every general character, the tide-water district of Virginia may be described as generally level, sandy, poor, and free from any fixed rock, or any other than stones rounded apparently by the attrition of water. On much the greater part of the lands, no stone of any kind is to be found of larger size than gravel. Pines of different kinds form the greater part of a heavy cover to the silicious soils in their virgin state, and mix considerably with oaks and other growth of clay land. Both these kinds of soil, after being exhausted of their little fertility by cultivation, and "turned out" to recruit, are soon covered by young pines which grow with vigor and luxuriance. This general description applies more particularly to the *ridges* which separate the *slopes* on different streams. The ridge lands are always level, and very poor—sometimes clayey, more generally sandy, but stiffer than would be inferred from the proportion of silicious earth they contain, which is caused by the fineness of its particles. Whortleberry bushes, as well as pines, are abundant on ridge lands—and numerous shallow basins are found, which are ponds of rain water in winter, but dry in summer. None of this large proportion of our lands has paid the expense of clearing and cultivation, and much the greater part still re-

mains under its native growth. Enough, however, has been cleared and cultivated in every neighborhood to prove its utter worthlessness under common management. The soils of ridge lands vary between sandy loam and clayey loam. It is difficult to estimate their general product under cultivation; but judging from my own experience of such soils, the product may be from five bushels of corn, or as much of wheat, to the acre on the most clayey soils, to twelve bushels of corn, and less than three of wheat, on the most sandy—if wheat were there attempted to be made.

The *slopes* extend from the ridges to the streams, or to the alluvial bottoms, and include the whole interval between neighboring branches of the same stream. This class of soils forms another great body of lands, of a higher grade of fertility, though still far from valuable. It is generally more sandy than the poorer ridge land, and when long cultivated is more or less deprived of its soil, by the washing of rains, on every slight declivity.

The washing away of three or four inches in depth exposes a sterile subsoil, (or forms a "gall,") which continues thenceforth bare of all vegetation. A greater declivity of the surface serves to form gullies several feet in depth, the earth carried from which, covers and injures the adjacent lower land. Most of this kind of land has been cleared and greatly exhausted. Its virgin growth is often more of oak, hickory, and dogwood, than pine; but when turned out of cultivation, an unmixed growth of pine follows. Land of this kind in general has very little durability. Its best usual product of corn may be, for a few crops, eighteen or twenty bushels—and even as much as twenty-five bushels, from the highest grade. Wheat is seldom a productive or profitable crop on the slopes, the soil being generally too sandy. When such soils as these are called rich or valuable (as most persons would describe them,) those terms must be considered as only comparative; and such an application of them proves that truly fertile and valuable soils are very scarce in lower Virginia.

The only very rich and durable soils below the falls of our rivers are narrow strips of high-land along their banks, and the low-lands formed by the alluvion of the numerous smaller streams which water our country. These alluvial bottoms, though highly productive, are lessened in value by being generally too sandy, and by the damage they suffer from being often inundated by floods of rain. The best high-land soils seldom extend more than half a mile from the river's edge—sometimes not fifty yards. These irregular margins are composed of loams of various qualities, but all highly valuable; and the best soils are scarcely to be surpassed in their original fertility, and durability under severe tillage. Their nature and peculiarities will be again adverted to, and more fully described hereafter.

The simple statement of the general course of tillage to which this part of the country has been subjected is sufficient to prove that great impoverishment of the soil has been the inevitable consequence. The small portion of rich river margins, was soon all cleared, and was tilled without cessation for many years. The clearing of the slopes was next commenced, and is not yet entirely completed. On these soils, the succession of crops was less rapid, or, from necessity, tillage was sooner suspended. If not rich enough for tobacco when first cleared, (or as soon as it ceased to be so,) land of this kind was planted in corn two or three years in succession, and afterwards every second year. The intermediate year between the crops of corn, the field was "rested" under a crop of wheat, if it would produce four or five bushels to the acre. If the sandiness, or exhausted condition of the soil, denied even this small product of wheat, that crop was probably not attempted; and, instead of it, the field was exposed to close grazing, from the time of gathering one crop of corn, to that of preparing

to plant another. No manure was applied, except on the tobacco lots; and this succession of a grain crop every year, and afterwards every second year, was kept up as long as the field would produce five bushels of corn to the acre. When reduced below that product, and to still more below the necessary expense of cultivation, the land was turned out to recover under a new growth of pines. After twenty or thirty years, according to the convenience of the owner, the same land would be again cleared, and put under similar scourging tillage, which, however, would then much sooner end, as before, in exhaustion. Such a general system is not yet every where abandoned; and many years have not passed, since such was the usual course on almost every farm.

How much our country has been impoverished during the last fifty years, cannot be determined by any satisfactory testimony. But, however we may differ on this head, there are but few who will not concur in the opinion, that [up to 1831] our system of cultivation has been every year lessening the productive power of our lands in general—and that no one county, no neighborhood, and but few particular farms, have been at all enriched, since their first settlement and cultivation. Yet many of our farming operations have been much improved and made more productive. Driven by necessity, proprietors direct more personal attention to their farms--better implements of husbandry are used—every process is more perfectly performed—and, whether well or ill directed, a spirit of inquiry and enterprise has been awakened, which before had no existence.

Throughout the country below the falls of the river, and perhaps thirty miles above, if the best land be excluded, say one tenth, the remaining nine tenths will not yield an average product of ten bushels of corn to the acre; though that grain is best suited to our soils in general, and far exceeds in quantity all other kinds raised. Of course, the product of a large proportion of the land would fall below this average. Such crops, in very many cases, cannot remunerate the cultivator. If our remaining wood-land could be at once brought into cultivation, the *gross* product of the country would be greatly increased, but the *net* product very probably diminished; as the general poverty of these lands would cause more expense than profit to accompany their cultivation under the usual system. Yet every year we are using all our exertions to clear wood-land, and in fact seldom increase either net or gross products—because nearly as much old exhausted land is turned out of cultivation as is substituted by the newly cleared. Sound calculations of profit and loss, would induce us even greatly to reduce the extent of our present cultivation, in lower Virginia, by turning out and leaving waste, (if not to be improved,) every acre that yields less than the total cost of its tillage.*

No political truth is better established than that the population of every country will increase, or diminish, according to its regular supply of food. We know from the census of 1830, compared with those of 1820 and 1810, that our population is nearly stationary, and in some counties is actually lessening; and therefore it is certain that [to 1830] our agriculture is not increasing the amount of food, or the means of purchasing food—with all the assistance of the new land annually brought under culture. In these cir-

*The foregoing description was written in 1826, and first published in 1831, and particular exceptions to the general correctness of the application had been even then recently exhibited; and, with the passage of every year since, these exceptions have been becoming more numerous and more important, and in a rapidly increasing ratio. These recent facts of improved lands and increased production, as well as their peculiar causes, will be treated of subsequently. The observations and deductions presented in the remainder of this chapter were also of the same date as the foregoing statements, on which they are founded.

cumstances, a surplus population, with all its deplorable consequences, is only prevented by the great current of emigration which is continually flowing westward. No matter who emigrates, or with what motive—the enterprising or wealthy citizen who leaves us to seek richer lands and greater profits, and the slave sold and carried away on account of his owner's poverty—all concur in producing the same result, though with very different degrees of benefit to those who remain. If this great and continued drain from our population was stopped, and our agriculture was not improved, want and misery would work to produce the same results. Births would diminish, and deaths would increase; and hunger and disease, operating here as in other countries, would keep down population to that number that the average products of our agricultural and other productive labor could feed, and supply with the other necessary means for living.

A stranger to our situation and habits might well oppose to my statements the very reasonable objection, that no man would, or could, long pursue a system of cultivation of which the returns fell short of his expenses, including rent of land, hire of labor, interest on the necessary capital, &c. Very true; if he had to pay those expenses out of his profits, he would soon be driven from his farm to a jail. But we own our land, our laborers, and stock; and though the calculation of net profit, or of loss, is precisely the same, yet we are not ruined by making only two per cent. on our capital, provided we can manage to live on that income. If we live on still less, we are actually growing richer, (by laying up a part of our two per cent.,) notwithstanding the most clearly proved regular loss on our farming.

Our condition has been so gradually growing worse, that we are either not aware of the extent of the evil, or are in a great measure reconciled by custom to profitless labor. No hope for a better state of things can be entertained, until we shake off this apathy—this excess of contentment, which makes no effort to avoid existing evils. I have endeavored to expose what is worst in our situation as farmers; if it should have the effect of arousing any of my countrymen to a sense of the absolute necessity of some improvement, to avoid ultimate ruin, I hope also to point out to some of their number, if not to all, that the means for certain and highly profitable improvements are completely within their reach.

The cultivators of eastern Virginia derive a portion of their income from a source quite distinct from their tillage—and which, though it often forces them to persist in their profitless farming, yet also, in some measure, conceals, and is generally supposed to compensate for its losses. This source of income is, the breeding and selling of slaves; of which, (though the discussion of this point will not be undertaken here,) I cannot concur in the general opinion that it is also a source of profit.

It is not meant to convey the idea that any person undertakes as a regular business the breeding of slaves with a view to their sale; but whether it is so intended or not, all of us, without exception, are acting some part in aid of a general system, which taken altogether is precisely what I have named. No man is so inhuman as to breed and raise slaves, to sell off a certain proportion regularly, as a western drover does with his herds of cattle. But sooner or later the general result is the same. Sales may be made voluntarily, or by the sheriff—they may be met by the first owner, or delayed until the succession of his heirs—or the misfortune of being sold may fall on one parcel of slaves, instead of another; but all these are but different ways of arriving at the same general and inevitable result. With plenty of wholesome though coarse food, and under such mild treatment as our slaves usually experience, they have every inducement and facility to increase their numbers with all possible rapidity, without any opposing

check, either prudential, moral, or physical. These several checks to the increase of population operate more or less on all free persons, whether rich or poor; and slaves, situated as ours are, perhaps are placed in the only possible circumstances in which no restraint whatever obstructs the propagation and increase of the race. From the general existence of this state of circumstances, the particular effects may be naturally deduced; and facts completely accord with what these circumstances promise. A gang of slaves on a farm will often increase to four times their original number, in thirty or forty years. If a farmer is only able to feed and maintain his slaves, their increase in value may double the whole of his capital originally vested in farming, before he closes the term of an ordinary life. But few farms are able to support this increasing expense, and also furnish the necessary supplies to the family of the owner; whence very many owners of large estates, in lands and negroes, are throughout their lives too poor to enjoy the comforts of wealth, or to encounter the expenses necessary to improve their unprofitable farming. A man so situated, may be said to be a slave to his own slaves. If the owner is industrious and frugal, he may be able to support the increasing number of his slaves, and to bequeath them undiminished to his children. But the income of few persons increases as fast as their slaves; and if not, the consequence must be, that some of them will be sold, that the others may be supported; and the sale of more is perhaps afterwards compelled, to pay debts incurred in striving to put off that dreaded alternative. The slave first almost starves his master, and at last is eaten by him—at least he is exchanged for his value in food. The sale of slaves is always a severe trial to their owner. Obstacles are opposed to it, not only by sentiments of humanity and of regard for those who have passed their lives in his service—but every feeling he has of false shame comes to aid; and such sales are generally postponed until compelled by creditors, and are carried into effect by the sheriff, or by the administrator of the debtor. But when the sale finally takes place, its magnitude makes up for all previous delays. Do what we will, the surplus slaves *must* be sent out of a country which is not able to feed them; and these causes continue to supply the immense numbers that are annually sold and carried away from lower Virginia, without even producing the political benefit of lessening the actual number remaining. Nothing can check this forced emigration of blacks, and the voluntary emigration of whites, except increased production of food, obtained by enriching our lands, and the consequent increase of farming profits. No effect will more certainly follow its cause than this—that whenever our land is so improved as to produce double its present supply of food, it will also have, and will retain, double its present amount of population. The improving farmer who adds one hundred bushels of corn to the previous product of his country, also effectually adds, and permanently, to its population, as many persons as his increase of product will feed and support.

CHAPTER III.

THE DIFFERENT CAPACITIES OF SOILS FOR RECEIVING IMPROVEMENT.

As far as the nature of the subjects permitted, the foregoing chapters have been merely explanatory and descriptive. The same subjects will be resumed and more fully treated in the course of the following general argument, the premises of which are the facts and circumstances that have been

detailed. The object of this essay will now be entered upon; and what is desired to be proved will be stated in a series of propositions, which will now be presented at one view, and afterwards separately discussed in their proper order.

Proposition 1. Soils naturally poor, and rich soils reduced to poverty by cultivation, are essentially different in their powers of retaining putrescent (or alimentary) manures; and, under like circumstances, the fitness of any soil to be enriched by these manures is in proportion to the degree of its natural fertility.

2d. The natural sterility of the soils of lower Virginia is caused by such soils being destitute of calcareous earth, and their being injured by the presence and effects of vegetable acid.

3d. The fertilizing effects of calcareous earth are chiefly produced by its power of neutralizing acids, and of combining putrescent manures with soils, between which there would otherwise be but little if any chemical attraction.*

4th. Poor and acid soils cannot be improved durably, or profitably, by putrescent manures, without previously making such soils calcareous, and thereby correcting the natural defect in their constitution.

5th. Calcareous manures will give to our worst soils a power of retaining putrescent manures, equal to that of the best—and will cause more productiveness, and yield more profit, than any other improvement practicable in lower Virginia.

Dismissing from consideration, for the present, all the others, I shall proceed to maintain the

First Proposition.—*Soils naturally poor, and rich soils reduced to poverty by cultivation, are essentially different in their powers of retaining putrescent (or alimentary) manures; and, under like circumstances, the fitness of any soil to be enriched by these manures is in proportion to the degree of its natural fertility.*

The *natural fertility* of a soil is not intended to be estimated by the amount of its earliest product, when first brought under cultivation, because several temporary causes then operate either to keep down or to augment the product. If land be cultivated immediately after the trees are cut down, the crop is greatly lessened by the numerous living roots, and consequent bad tillage—by the excess of unrotted vegetable matter—and the coldness of the soil, from which the rays of the sun had been so long excluded. On the other hand, if cultivation is delayed one or two years, the leaves and other vegetable matters are rotted, and in the best state to supply food to plants, and are so abundant, that a far better crop will be raised than could have been obtained before, or perhaps can be again, without manure. For these reasons, the degree of natural fertility of any soil should

* When any substance is mentioned as *combining* with one or more other substances, as different manures with each other, or with soil, I mean that a union is formed by chemical attraction, and not by simple mixture. *Mixtures* are made by mechanical means, and may be separated in like manner; but *combinations* are chemical, and require some stronger chemical attraction, to take away either of the bodies so united.

When two substances combine, they both lose their previous peculiar qualities, or *neutralize* them for each other, and form a third substance different from both. Thus, if certain known proportions of *muriatic acid* and pure or caustic *soda* be brought together, their strong attraction will cause them to combine immediately. The strong corrosive acid quality of the one, and the equally peculiar alkaline taste and powers of the other, will *neutralize* or entirely destroy each other—and the compound formed is common table *salt*, the qualities of which are as strongly marked, but totally different from those of either of its constitutent parts.

be measured by its products after these temporary causes have ceased to act, which will generally take place before the third or fourth crop is obtained. According, then, to this definition, a certain degree of *permanency* in its early productiveness is necessary to entitle a soil to be termed *naturally fertile.* It is in this sense that I deny to any poor lands, except such as were naturally fertile, the capacity of being made rich by putrescent manures only.

The foregoing proposition would by many persons be so readily admitted as true, that attempting to prove it would be deemed entirely superfluous. But many others will as strongly deny its truth, and can support their opposition by high agricultural authorities.

General readers, who may have no connexion with farming, must have gathered from the incidental notices in various literary and descriptive works, that some countries or districts that were noted for their uncommon fertility or barrenness, as far back as any accounts of them have been recorded, still retain the same general character, through every change of culture, government, and even of races of inhabitants. They know that, for some centuries at least, there has been no change in the strong contrast between the barrenness of Norway, Brandenburg, and the Highlands of Scotland, and the fertility of Flanders, Lombardy and Valencia. Sicily, notwithstanding its government is calculated to discourage industry, and production of every profitable kind, still exhibits that fertility for which it was celebrated two thousand years ago. It seems a necessary inference from the many statements of which these are examples, that the labors of man have been but of little avail in altering, generally or permanently, or in any marked degree, the characters and qualities given to soils by nature.

Most of our experienced practical cultivators, through a different course, have arrived at the same conclusion. Their practice has taught them the truth of this proposition; and the opinions thus formed have profitably directed their most important operations. They are accustomed to estimate the worth of land by its natural degree of fertility; and by the same rule they are directed on what soils to bestow their scanty stock of manure, and where to expect exhausted fields to recover by rest, and their own unassisted powers. But, content with knowing the fact, this useful class of farmers have never inquired for its cause; and even their opinions on this subject, as on most others, have not been communicated so as to benefit others.

But if all literary men, who are not farmers, and all practical cultivators, who seldom read, admitted the truth of my proposition, it would avail but little for improving our agricultural operations; and the only prospect of its being usefully disseminated is through that class of farmers who have received their first opinions of improving soils from books, and whose subsequent plans and practices have grown out of those opinions. If poor natural soils cannot be durably or profitably improved by putrescent manures, this truth should not only be known, but be kept constantly in view, by every farmer who can hope to improve with success. Yet it is a remarkable fact, that the difference in the capacities of soils for receiving improvement has not attracted the attention of scientific farmers; and the doctrine has no direct and positive support from the author of any treatise on agriculture, European or American, that I have been able to consult. On the contrary, it seems to be considered by all of them, that to collect and apply as much vegetable and animal manure as possible, is sufficient to ensure profit to every farmer, and fertility to every soil. They do not tell us that numerous exceptions to that rule will be found, and that many soils of apparently good texture, if not incapable of being enriched from the barnyard, would at least cause more loss than clear profit, by being improved from that source.

When it is assumed that the silence of every distinguished author as to certain soils being incapable of being profitably enriched, amounts to ignorance of the fact, or a tacit denial of its truth—it may be objected that the exception was not omitted from either of these causes, but because it was established and undoubted. This is barely possible; but even if such were the case, their silence has had all the ill consequences that could have grown out of a positive denial of any exceptions to the propriety of manuring poor soils. Every zealous young farmer, who draws most of his knowledge and opinions from books, adopts precisely the same idea of their directions—and if he owns barren soils he probably throws away his labor and manure for their improvement, for years, before experience compels him to abandon his hopes, and acknowledge that his guides have led him only to failure and loss. Such farmers as I allude to, by their enthusiasm and spirit of enterprise, are capable of rendering the most important benefits to agriculture. Whatever may be their impelling motives, the public derives nearly all the benefit of their successful plans; and their far more numerous misdirected labors, and consequent disappointments, are productive of national, still more than individual loss. The occurrence of only a few such mistakes, made by reading farmers, will serve to acquit me of combating a shadow—and there are few of us who cannot recollect some such examples.

But if the foregoing objection has any weight in justifying European authors in not naming this exception, it can have none for those of our own country. If it is admitted that soils naturally poor are incapable of being enriched with profit, that admission must cover three fourths of all the highland in the tide-water district. Surely no one will contend that so sweeping an exception was silently understood by the author of '*Arator*,' as qualifying his exhortations to improve our lands: and if no such exception were intended to be made, then will his directions for enriching soils and his promises of reward be found equally fallacious, for the greater portion of the country for the benefit of which his work was especially intended. The omission of any such exception, by the writers of the United States, is the more remarkable, as the land has been so recently brought under cultivation, that the original degree of fertility of almost every farm may be known to its owner, and compared with the after progress of exhaustion or improvement.

Many authorities might be adduced to prove that I have correctly stated what is the fair and only inference to be drawn from agricultural books, respecting the capacity of poor soils to receive improvement. But a few of the most strongly marked passages in 'Arator' will be fully sufficient for this purpose. The venerated author of that work was too well acquainted with the writings of European agriculturists, to have mistaken their doctrines in this important particular. A large portion of his useful life was devoted to the successful improvement of exhausted, but originally fertile lands. His instructions for producing similar improvements are expressly addressed to the cultivators of the eastern parts of Virginia and North Carolina, and are given as applicable to all our soils, without exception. Considering all these circumstances, the conclusions which are evidently and unavoidably deduced from his work, may be fairly considered, not only as supported by his own experience, but as concurring with the general doctrine of improving poor soils, maintained by previous writers.

At page 54, third edition of 'Arator,' "*inclosing*" (i. e. leaving fields to receive their own vegetable cover, for their improvement, during the years of rest) is said to be "the most powerful means of fertilizing the earth" —and the process is declared to be rapid, the returns near, and the gain great.

Page 61. "If these few means of fertilizing the country [corn-stalks, straw, and animal dung,] were skilfully used, they would of themselves suffice to change its state from sterility to fruitfulness."—"By the litter of Indian corn, and of small grain, and of penning cattle, managed with only an inferior degree of skill, in union with inclosing, I will venture to affirm that a farm may in ten years be made to double its produce, and in twenty to quadruple it."

No opinions could be more strongly or unconditionally expressed than these. No reservation or exception is made. I may safely appeal to each of the many hundreds who have attempted to obey these instructions, to declare whether any one considered his own naturally poor soils excluded from the benefit of these promises—or whether a tithe of the promised benefit was realized on any farm composed generally of such soils.

In a field of mine that has been secured from grazing since 1814, and cultivated on the mild four-shift rotation, the produce of a marked spot has been measured every fourth year (when in corn) since 1820. The difference of product has been such as the differences of season might have caused—and the last crop (in 1828) was worse than those of either of the two preceding rotations. There is no reason to believe that even the smallest increase of productive power had taken place in all the preceding fourteen years. Nor has there been, since 1828, in the apparent products of this ground, any manifestation that there has been any more of subsequent than of previous improvement, from the vegetable manurings furnished by its growth.

A still more striking proof, because of the much larger scale, as well as long continuance of the experiment, has been very recently, (in 1842,) as well as in former times, mentioned to me, as confirmation of my views in this respect. Col. George Blow, of Sussex, a highly respectable gentleman, and intelligent and observant farmer, has adhered for nearly 30 years to Taylor's "inclosing system," and with a very mild rotation, on a farm of 600 arable acres, of sandy soil, and originally poor; and has taken but one crop (corn) in every three years. A few spots only of better quality, (the sites of old buildings, &c.,) were put in wheat or oats after the corn; the great body of the land having had regularly two years in three to rest, and to manure itself by its volunteer growth of weeds and grass. Very little grazing, and that but rarely, has been permitted. There could have been no material mistake as to the general products and results; and the proprietor is confident that the land has not improved in production in all this long time. Yet, on soil differently constituted, Col. Blow has improved and increased the products, rapidly and profitably. These two facts, though observed more particularly and for longer time than any others known, agree with, and are but confirmatory of others presented to some extent on almost every farm in the tide-water region of Virginia.

It is far from my intention, by these remarks, and statements of facts, to deny the propriety, or to question the highly beneficial results, of applying the system of improvement recommended by 'Arator,' to soils originally fertile. On the contrary, it is as much my object to maintain the facility of restoring to worn lands their natural degree of fertility, by vegetable applications, as it is to deny the power of exceeding that degree, however low it may have been.

One more quotation will be offered, because its recent date and the source whence it is derived furnish the best proof that it is still the received opinion, among agricultural writers, that all soils may be profitably improved by putrescent manures. An article in the '*American Farmer*,' of October 14th, 1831, on "manuring large farms," by the editor, (G. B.

Smith,) contains the following expressions. "By proper exertions, every farm in the United States can be manured with less expense than the surplus profits arising from the manure would come to. This we sincerely believe, and we have arrived at this conclusion from long and attentive observation. We never yet saw a farm that we could not point to means of manuring, and bring into a state of high and profitable cultivation at an expense altogether inconsiderable when contrasted with the advantages to be derived from it." The remainder of the article shows that putrescent manures are principally relied on to produce these effects; marsh and swamp mud are the only kinds referred to that are not entirely putrescent in their action, and mud certainly cannot be used to manure every farm. Mr. Smith having been long the conductor of a valuable agricultural journal, as a matter of course, is extensively acquainted with the works and opinions of the best writers on agriculture; and therefore, his advancing the foregoing opinions, as certain and undoubted, is as much a proof of the general concurrence therein of preceding writers, as if the same had been given as a digest of their precepts.

Some persons will readily admit the great difference in the capacities of soils for improvement, but consider a deficiency of clay only to cause the want of power to retain manures. The general excess of sand in our poor lands might warrant this belief in a superficial and limited observer. But though clay soils are more rarely met with, they present, in proportion to their extent, full as much poor land. The most barren and worthless soils in the county of Prince George are also the stiffest. A poor clay soil will retain manure longer than a poor sandy soil—but it will not the less certainly lose its acquired fertility at a somewhat later period. When it is considered that a much greater quantity of manure is required by clay soils, it may well be doubted whether the temporary improvement of the sandy soils would not be attended with more profit—or, more properly speaking, with less actual loss.

It is true that the capacity of a soil for improvement is greatly affected by its texture, shape of the surface, and its supply of moisture. Dry, level, or clay soils, will retain manure longer than the sandy, hilly, or wet. But however important these circumstances may be, neither the presence or absence of any of them can cause the essential differences of capacity for improvement. There are some rich and valuable soils with either one or more of all these faults—and there are other soils the least capable of receiving improvement, free from objections as to their texture, degree of moisture, or inclination of their surface. Indeed the great body of our poor ridge lands are more free from faults of this kind, than soils of far greater productiveness usually are. Unless then some other and far more powerful obstacle to improvement exists, why should not all our wood-land be highly enriched, by the hundreds, or thousands, of crops of leaves which have successively fallen and rotted there? Notwithstanding this vegetable manuring, which infinitely exceeds all that the industry and patience of man can possibly equal, most of our wood-land remains poor; and this one fact (which at least is indisputable) ought to satisfy all of the impossibility of enriching such soils by putrescent manures only. Some few acres may be highly improved, by receiving all the manure derived from the offal of the whole farm—and entire farms, in the neighborhood of towns, may be kept rich by continually applying large quantities of purchased manures. But no where can a farm be found, which has been improved beyond its original fertility, by means of the vegetable resources of its own arable fields. If this opinion is erroneous, nothing is easier than to prove my mistake, by adducing undoubted examples of such improvements having been made.

But a few remarks will suffice on the capacity for improvement of worn

lands, which were originally fertile. With regard to these soils, I have only to concur in the received opinion of their fitness for durable and profitable improvement by putrescent manures. After being exhausted by cultivation, they will recover their productive power, by merely being left to rest for a sufficient time, and receiving the manure made by nature, of the weeds and other plants that grow and die upon the land. Even if robbed of the greater part of that supply, by the grazing of animals, a still longer time will serve to obtain the same result. The better a soil was at first, the sooner it will recover by these means, or by artificial manuring. On soils of this kind, the labors of the improving farmer meet with certain success and full reward; and whenever we hear of remarkable improvements of poor lands by putrescent manures, further inquiry will show us that these poor lands had once been rich.

The continued fertility of certain countries, for hundreds or even thousands of years, does not prove that the land could not be, or had not been, exhausted by cultivation; but only that it was slow to exhaust and rapid in recovering; so that whatever repeated changes may have occurred in each particular tract, the whole country taken together always retained a high degree of productiveness. Still the same rule will apply to the richest and the poorest soils—to wit, that each exerts strongly a force to retain as much fertility as nature gave to it—and that when worn and reduced, each kind may easily be restored to its original state, but cannot be raised higher, with either durability or profit, by putrescent manures, whether applied by the bounty of nature, or the industry of man.

CHAPTER IV.

EFFECTS OF THE PRESENCE OF CALCAREOUS EARTH IN SOILS.

PROPOSITION 2.—*The natural sterility of the soils of lower Virginia is caused by such soils being destitute of calcareous earth, and their being injured by the presence and effects of vegetable acid.*

The means which would appear the most likely to lead to the causes of the different capacities of soils for improvement is to inquire whether any known ingredient or quality is always to be found belonging to improvable soils, and never to the unimprovable—or which always accompanies the latter, and never the former kind. If either of these results can be obtained, we will have good ground for supposing that we have discovered the general cause of fertility, in the one case, or of barrenness, in the other; and it will follow that, if we can supply to barren soils the deficient beneficial ingredient—or can destroy that which is injurious to them—their incapacity for receiving improvement will be removed. All the common ingredients of soils, as sand, clay, or gravel—and such qualities as moisture or dryness—a level, or a hilly surface—however they may affect the value of soils, are each sometimes found exhibited, in a remarkable degree, in both the fertile and the sterile. The abundance of putrescent vegetable matter might well be considered the cause of fertility, by one who judged only from lands long under cultivation. But though vegetable matter in sufficient quantity is essential to the existence of fertility, yet will this substance also be found inadequate for the cause. Vegetable matter abounds in all rich land, it is admitted; but it has also been furnished by nature, in quantities exceeding all computation, to the most barren soils known.

But there is one ingredient of which not the smallest proportion can be found in any of our poor soils, and which, wherever found, indicates a soil remarkable for natural and durable fertility. This is *calcareous earth*, or carbonate of lime. These facts alone, if sustained, will go far to prove that this earth is the cause of fertility, and the cure for barrenness.

On some part of most farms touching tide-water, either muscle or oyster shells are found mixed with the soil. Oyster shells are confined to the lands on salt water, where they are very abundant, and sometimes extend through large fields. Higher up the rivers, muscle shells only are to be seen thus deposited by nature, or by the aboriginal inhabitants, and they decrease as we approach the falls of the rivers. The proportion of shelly land in the counties highest on tide-water is very small; but the small extent of these spots does not prevent, but rather aids, the exhibition of the peculiar qualities of such soils. Spots of shelly land, not exceeding a few acres in extent, could not well have been cultivated differently from the balance of the fields of which they formed parts—and therefore they can be better compared with the worse soils under like treatment. Every acre of shelly land is, or has been, remarkable for its richness, and still more for its durability. There are few farmers among us who have not heard described tracts of shelly soil on Nansemond and York rivers, which are celebrated for their long resistance of the most exhausting course of tillage, and which still remain fertile, notwithstanding all the injury which they must have sustained from their severe treatment. We are told that on some of these lands, corn has been raised every successive year, without any help from manure, for a longer time than the owners could remember, or could be informed of correctly. But without relying on any such remarkable cases, there can be no doubt that every acre of our shelly land has been at least as much tilled, and as little manured, as any in the country; and that it is still the richest and most valuable of all our old cleared lands.

The fertile but narrow strips, along the banks of our rivers, (which form the small portion of our high-land of first-rate quality,) seldom extend far without exhibiting spots in which shells are visible, so that the eye alone is sufficient to prove the soil of such places to be calcareous. The similarity of natural growth, and of all other marks of character, are such, that the observer might very naturally infer that the former presence of shells had given the same valuable qualities to all these soils—but that they had so generally rotted, and been incorporated with the other earths, that they remained visible only in a few places, where they had been most abundant. The accuracy of this inference will hereafter be examined.

The natural growth of the shelly soils (and of those adjacent of similar value) is entirely different from that of the great body of our lands. Whatever tree thrives well on the one, is seldom found on the other class of soils—or, if found, it shows plainly, by its imperfect and stunted condition, on how unfriendly a soil it is placed. To the rich river margins are almost entirely confined the black or wild locust, hackberry or sugar-nut tree, and papaw. The locust is with great difficulty eradicated, or the newer growth of it kept under on cultivated lands; and from the remarkable rapidity with which it springs up and increases in size, it forms a serious obstacle to the cultivation of land on the river banks. Yet on the wood-land only a mile or two from the river, not a locust is to be seen. On shelly soils, pines and broom grass [*Andropogon scoparius?*] cannot thrive, and are rarely able to maintain even the most sickly growth.

Some may say that these striking differences of growth do not so much show a difference in the constitution of the soils, as in their state of fertility; or that one class of the plants above named delights in rich, and the other

in poor land. No plant prefers poor to rich soil—or can thrive better on a scarcity of food, than with an abundant supply. Pine, broom-grass, and sheep-sorrel, delight in a class of soils that are generally unproductive—but not on account of their poverty; for all these plants show, by the greater or less vigor of their growth, the abundance or scarcity of vegetable matter in the soil. But on this class of soils, no quantity of vegetable manure could make locusts flourish, though they will grow rapidly on a calcareous hill-side, from which all the soil capable of supporting other ordinary plants has been washed away.

In thus describing and distinguishing soils by their growth, let me not be understood as extending these rules to other soils and climates than our own. It is well established that changes of kind in successive growths of timber have occurred in other places, without any known cause; and a difference of climate will elsewhere produce effects, which here would indicate a change of soil.

Some rare exceptions to the general fertility of shelly lands are found where the proportion of calcareous earth is in great excess. Too much of this ingredient causes even a greater degree of sterility than its total absence. This cause of barrenness is very common in France and England, (on chalk soils,) and very extensive tracts are not worth the expense of cultivation, or improvement. The few small spots that are rendered barren here are seldom (if ever) so affected by the excess of oyster or muscle shells in the soil. These effects generally are caused by beds of fossil seashells, which in some places reach the surface, and are thus exposed to the plough. These spots are not often more than thirty feet across, and their nature is generally evident to the eye; and if not, is so easily determined by chemical tests, as to leave no reason for confounding the injurious and beneficial effects of calcareous earth. This exception to the general fertilizing effect of this ingredient of our soils would scarcely require naming, but to mark what might be deemed an apparent contradiction. But this exception, and its cause, must be kept in mind, and considered as always understood and admitted throughout all my remarks, and which therefore it is not necessary to name specially, when the general qualities of calcareous earth are spoken of.

In the beginning of this chapter, I advanced the important fact that none of our poor soils contain naturally the least particle of calcareous earth. So far, this is supported merely by my assertion—and all those who have studied agriculture in books will require strong proof before they can give credit to the existence of a fact, which is either unsupported, or indirectly denied, by all written authority. Others, who have not attended to such descriptions of soils in general, may be too ready to admit the truth of my assertion—because, not knowing the opinions on this subject heretofore received and undoubted, they would not be aware of the importance of their admission.

It is true that no author has said expressly that every soil contains calcareous earth. Neither perhaps has any one stated that every soil contains some silicious or aluminous earth. But the manner in which each one has treated of soils and their constituent parts, would cause their readers to infer that neither of these three earths is ever entirely wanting—or at least that the entire absence of the calcareous is as rare as the absence of silicious or aluminous earth. Nor are we left to gather this opinion solely from indirect testimony, as the following examples, from the highest authorities, will prove. Davy says, "four earths generally abound in soils, the aluminous, the silicious, the calcareous, and the magnesian"*; and the soils

* Davy's Agr. Chem., Lecture I

of which he states the constitutent parts, obtained by chemical analysis, as well as those reported by Kirwan, and by Young, all contain some proportion (and generally a large proportion) of calcareous earth.* Kirwan states the component parts of a soil which contained thirty-one per cent. of calcareous earth, and he supposes that proportion neither too little nor too much.† Young mentions soils of extraordinary fertility containing seventeen and twenty per cent., besides others with smaller proportions of calcareous earth—and says that Bergman found thirty per cent. in the best soil he examined.‡ Rozier speaks still more strongly for the general diffusion, and large proportions of this ingredient of soils. In his general description of earths and soils, he gives examples of the supposed composition of the three grades of soils which he designates by the terms *rich*, *good*, and *middling soils;* to the first class he assigns a proportion of one tenth, to the second, one fourth, and to the last, one half of its amount, of calcareous earth. The fair interpretation of the passage is that the author considered these large proportions as general, in France—and he gives no intimation of any soil entirely without calcareous earth.§

The position assumed above, of the general or universal concurrence of former European authors in the supposed general presence of calcareous earth in soils, could be placed beyond dispute by extracts from their publications. But this would require many and long extracts, too bulky to include here, and which cannot be fairly abridged, or exhibited by a few examples. No author says directly, indeed, that calcareous earth is present in all soils; but its being always named as one of the ingredients of soils in general, and no cases of its absolute deficiency in tilled lands being directly stated, amount to the declaration that calcareous earth is very rarely, if ever, entirely wanting in any soil. We may find enough directions to apply calcareous manures to soils that are deficient in that ingredient; but that deficiency seems to be not spoken of as *absolute*, but *relative* to other soils more abundantly supplied. In the same manner, writers on agriculture direct clay, or sand, to be used as manure for soils very deficient in one or the other of those earths; but without meaning that any soil under cultivation can be found entirely destitute of sand or of clay. My proofs from general treatises would therefore be generally indirect; and the quotations necessary to exhibit them would show what had *not* been said, rather than what *had*—and that they did *not* assert the absence of calcareous earth, instead of directly asserting its universal presence. Extracts for this purpose, however satisfactory, would necessarily be too voluminous, and it is well that they can be dispensed with. Better proof, because it is direct, and more concise, will be furnished by quoting the opinions of a few agriculturists of our own country, who were extensively acquainted with European authors, and have evidently drawn their opinions from those sources. These quotations will not only show conclusively that their authors consider the received European doctrine to be that all soils are more or less calcareous—but also, that they apply the same general cha-

* Agr. Chem., Lect. 4.—Kirwan on Manures—and Young's Prize Essay on Manures.

† Kirwan on Manures, article "Clayey Loam."

‡ Young's Essay on Manures.

§ "*Composition of soils.* Examples of the various composition of soils: *Rich soil;* silicious earth, 2 parts; aluminous, 6; calcareous, 1; vegetable earth, [*humus*] 1; in all, 10 parts. *Good soil*—silicious, 3 parts; aluminous 4; calcareous 2½; vegetable earth, ½ of 1 part; in all, 10 parts. *Middling soil* [*sol mediocre*;] silicious, 4 parts; aluminous, 1; calcareous, 5 parts, less by some atoms of vegetable earth; in all, 10 parts. We see that it is the largest proportion of aluminous earth that constitutes the greatest excellence of soils; and we know that independently of their harmony of composition, they require a sufficiency of depth."—Translated from the article "*Terres*," in the "Cours Complet d'Agriculture Pratique, etc. par l'Abbe Rozier, 1815.

racter to the soils of the United States, without expressing a doubt or naming an exception. These writers, as all who have heretofore written of soils in this country, have uttered but the echoes of preceding English general descriptions of soils. They seem not to have suspected that any very important difference existed in this respect between the soils of England and of this country, and certainly not one had made the slightest investigation by any attempt at chemical analysis, to sustain the false character thus given to our soils.

1. From a "Treatise on Agriculture," (ascribed to General Armstrong,) published in the American Farmer. [*Vol. i. page* 153.]

"Of six or eight substances, which chemists have denominated earths, four are *widely and abundantly diffused*, and form the crust of our globe. These are silica, alumina, lime, and magnesia."—"In a pure or isolated state, these earths are wholly unproductive; but when decomposed and mixed, and to this mixture is added the residuum of dead animal or vegetable matter, they become fertile, and take the general name of soils, and are again denominated after the earth that most abounds in their composition respectively."

2. Address of R. H. Rose to the Agricultural Society of Susquehanna. [*Am. Far. Vol. ii. p.* 101.]

"Geologists suppose our earth to have been masses of rock of various kinds, but principally silicious, aluminous, calcareous, and magnesian—from the gradual attrition, decay, and *mixture* of which, together with an addition of vegetable and animal matter, is formed the soil; and this is called sandy, clayey, calcareous, or magnesian, according as the particular primitive material preponderates in its formation."

3. Address of Robert Smith to the Maryland Agricultural Society. [*Am. Far. Vol. iii. p.* 228.]

"——The soils *of our country* are in general clay, sand, gravel, clayey loam, sandy loam, and gravelly loam. Clay, sand, and gravel, need no description, &c."—"*Clayey loam* is a compound soil, consisting of clay and sand or gravel, with a mixture of *calcareous matter*, and in which clay is predominant. *Sandy or gravelly loam* is a compound soil, consisting of sand or gravel and clay with a mixture of *calcareous matter*, and in which sand or gravel is predominant."

The first two extracts merely state the geological theory of the formation of soils, which is received as correct by the most eminent agriculturists of Europe. How far it may be supported or opposed by the actual constitution and number of ingredients of European soils, is not for me to decide, nor is the consideration necessary to my subject. But the adoption of this general theory by American writers, without excepting American soils, is an indirect, but complete application to them of the same character and composition. The writer last quoted states positively, that the various loams (which comprise at least nineteen twentieths of *our* soils, and I presume also of the soils of Maryland,) contain calcareous matter. The expression of this opinion by Mr. Smith is sufficient to prove that such was the fair and plain deduction from his general reading on agriculture, from which source only could his opinions have been derived. If the soils of Maryland are not very unlike those of Virginia, I will venture to assert, that not one in a thousand of all the clayey, sandy, and gravelly loams, contains the smallest proportion of *carbonate of lime*—and that not a single specimen of calcareous soil can be found, between the falls of the rivers and the most eastern body of limestone.

But though the direct testimony of European authors, as cited in a foregoing page, concurs with the indirect proofs referred to since to induce the belief that soils are very rarely destitute of calcareous earth, yet state-

ments may be found of some particular soils being considered of that character. These statements, even if presented by the authors of general treatises, would only seem to present exceptions to their general rule of the almost universal diffusion of calcareous earth in soils. But, so far as I know, no such exceptions are named in the descriptions of soils in any general treatise, and therefore have not the slightest influence in contradicting or modifying their testimony on this subject. It is in the description of soils of particular farms, or districts, that some such statements are made; and even if no such examples had been mentioned, they would not have been needed to prove the existence, in Europe, of some soils, like most of ours, destitute of calcareous earth. These facts do not oppose my argument. I have not asserted, (nor believed, since I have endeavored to investigate this subject,) that there were not soils in Europe, and perhaps many extensive districts, containing no calcareous earth. My argument merely maintains, that these facts would not be inferred, but the contrary, by any general and cursory reader of the agricultural treatises of Europe with which we are best acquainted. It has not been my purpose to inquire as to the existence, or extent, of soils of this kind in Europe. But judging from the indirect testimony furnished by accounts of the mineral and vegetable productions, in general descriptions of different countries, I would infer that soils having no calcareous earth were often found in Scotland and the northern part of Germany, and that they were comparatively rare in England and France.

With my early impressions of the nature and composition of soils, derived in like manner from the general descriptions given in books, it was with surprise, and some distrust, that, when first attempting to analyze soils, in 1817, I found most of the specimens entirely destitute of calcareous earth. The trials were repeated with care and accuracy, on soils from various places, until I felt authorized to assert, without fear of contradiction, that no naturally poor soil, below the falls of the rivers, contains the smallest proportion of calcareous earth. Nor do I believe that any exception to this peculiarity of constitution can be found in any poor soil above the falls; but though these soils are far more extensive and important in other respects, they are beyond the district within the limits of which I propose to confine my investigation.

These results are highly important, whether considered merely as serving to establish my proposition, or as showing a radical difference between most of our soils, and those of the best cultivated parts of Europe. Putting aside my argument to establish a particular theory of improvement, the ascertained fact of the universal absence of calcareous earth in our poor soils leads to this conclusion, that profitable as calcareous manures have been found to be in countries where the soils are generally calcareous in some degree, they must be far more so on our soils that are quite destitute of that necessary earth.

CHAPTER V.

RESULTS OF THE CHEMICAL EXAMINATIONS OF VARIOUS SOILS.

Proposition 2.—continued.

The certainty of any results of chemical analysis would be doubted by most persons who have paid no attention to the means employed for such operations; and their incredulity will be the more excusable, when such

results are reported by one knowing very little of the science of chemistry, and whose limited knowledge was gained without aid or instruction, and was sought solely with the view of pursuing this investigation. Appearing under such disadvantages, it is therefore the more incumbent on me to show my claim to accuracy, or to so explain my method as to enable others to detect its errors, if any exist. To analyze a specimen of soil completely requires an amount of scientific acquirement and practical skill to which I make no pretension. But merely to ascertain the absence of calcareous earth, (or carbonate of lime,) or, if present, to find its quantity, requires but little skill, and less science.

The methods recommended by different agricultural chemists for ascertaining the proportion of calcareous earth in soils agree in all material points. Their process will be described, and made as plain as possible. A specimen of soil of convenient size is dried, pounded, and weighed, and then thrown into muriatic acid diluted with three or four times its quantity of water. The acid combines with, and dissolves the *lime* of the calcareous earth, and its other ingredient, the *carbonic acid*, being disengaged, rises through the liquid in the form of *gas*, or air, and escapes with effervescence. After the mixture has been well stirred, and has stood until all effervescence is over, (the fluid still being somewhat acid to the taste, to prove that enough acid had been used, by some excess being left,) the whole is poured into a piece of blotting paper, folded so as to fit within a glass funnel. The fluid containing the dissolved lime passes through the paper, leaving behind the clay and silicious sand, and any other solid matter; over which, pure water is poured and passed off several times, so as to wash off all remains of the dissolved lime. These filtered washings are added to the solution, to all of which is then poured a solution of *carbonate of potash*. The two dissolved salts thus thrown together, (*muriate of lime* composed of muriatic acid and lime, and *carbonate of potash*, composed of carbonic acid and potash,) immediately decompose each other, and form two new combinations. The muriatic acid leaves the lime, and combines with the potash, for which it has a stronger attraction—and the muriate of potash thus formed, being a soluble salt, remains dissolved and invisible in the water. The lime and carbonic acid being in contact, when let loose by their former partners, instantly unite, and form *carbonate of lime*, or calcareous earth, which being insoluble, falls to the bottom. This precipitate is then separated by filtering paper, is washed, dried and weighed, and thus shows the proportion of carbonate of lime contained in the soil.*

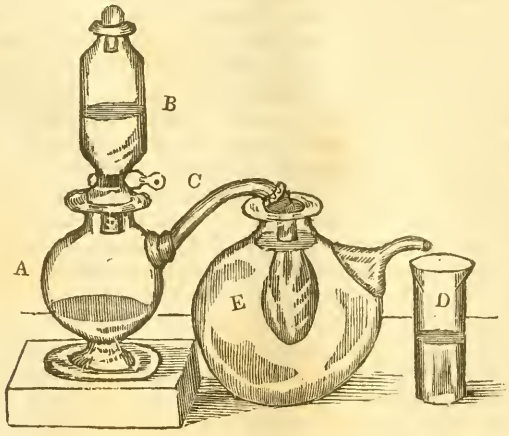
In this process, the carbonic acid which first composed part of the calcareous earth, escapes into the air, and another supply is afterwards furnished from the decomposition of the carbonate of potash. But this change of one of its ingredients does not alter the quantity of the calcareous earth, which is always composed of certain invariable proportions of its two component parts; and when all the lime has been precipitated as above directed, it will necessarily be combined with precisely its first quantity of carbonic acid.

This operation is so simple, and the means for conducting it so easy to obtain, that it will generally be the most convenient mode for finding the proportion of calcareous earth in those manures that are known to contain it abundantly, and where an error of a few grains cannot be very material. But if a very accurate result is necessary, this method will not serve, on account of several causes of error which always occur. Should no calcareous

* More full directions for the analysis of soils may be found in Kirwan's Essay on Manures, Rozier's Cours Complet, &c., and Davy's Agricultural Chemistry.

earth be present in a soil thus analyzed, the muriatic acid will take up a small quantity of aluminous earth, which will be precipitated by the carbonate of potash, and without further investigation, would be considered as so much calcareous earth. And if any compounds of lime and vegetable acids are present, (which for reasons hereafter to be stated, I believe to be not uncommon in soils,) some portion of them may be dissolved, and appear in the result as *carbonate* of lime, though not an atom of that substance was in the soil. Thus, every soil examined by this method of solution and precipitation will yield some small result of what would appear as carbonate of lime, though actually destitute of such an ingredient. The inaccuracies of this method were no doubt known (though passed over without notice) by Davy, and other men of science who have recommended its use; but as they considered calcareous earth merely as one of the earthy ingredients of soil, operating mechanically, (as do sand and clay,) on the texture of the soil, they would scarcely suppose that a difference of a grain or two could materially affect the practical value of an analysis, or the character of the soil under examination.*

The pneumatic apparatus proposed by Davy, as another means for showing the proportion of calcareous earth in soils, is liable to none of these objections; and when some other causes of error peculiar to this method, are known and guarded against, its accuracy is almost perfect, in ascertaining the quantity of calcareous earth—to which substance alone its use is limited. The following representation and description will make the operation quite clear.



"A, B, C, D, represent the different parts of this apparatus. A represents the bottle for receiving the soil. B the bottle containing the acid, furnished with a stop-cock. C the tube connected with a flaccid bladder. D the graduated measure. E the bottle for containing the bladder. When this instrument is used, a given quantity of soil is introduced into A. B is filled with muriatic acid diluted with an equal quantity of water; and the stop-cock being closed, is connected with the upper orifice of A, which is

* "Chalks, calcareous marls, or powdered limestone, *act merely by forming a useful earthy ingredient in the soil*, and their efficacy is proportioned to the deficiency of calcareous matter, which in larger or smaller quantities *seems to be an essential ingredient of all fertile soils;* necessary *perhaps* to their proper texture, and as an ingredient in the organs of plants." [Davy's Agr. Chem. page 21—and further on he says] "Chalk and marl or carbonate of lime *only improve the texture of a soil, or its relation to absorption; it acts merely as one of its earthy ingredients.*"

ground to receive it. The tube C is introduced into the lower orifice of A, and the bladder connected with it placed in its flaccid state into E, which is filled with water. The graduated measure is placed under the tube of E. When the stop-cock of B is turned, the acid flows into A, and acts upon the soil; the elastic fluid generated passes through C into the bladder, and displaces a quantity of water in E equal to it in bulk, and this water flows through the tube into the graduated measure; and gives by its volume the indication of the proportion of carbonic acid disengaged from the soil; for every ounce measure of which two grains of carbonate of lime may be estimated."—*Davy's Agr. Chem.*

The correctness of this mode of analysis depends on two well-established facts in chemistry: 1st, That the component parts of calcareous earth always bear the same proportion to each other, and these proportions are as forty-four parts (by weight) of carbonic acid, to fifty-six of lime. 2d, That the carbonic acid gas which two grains of calcareous earth will yield is equal in bulk to one ounce of fresh water. The process, with the aid of this apparatus, disengages, confines, and measures the gas evolved; and for every measure equal to the bulk of an ounce of water, the operator has but to allow two grains of calcareous earth in the soil acted on. It is evident that the result can indicate the presence of lime in no other combination except that which forms calcareous earth; nor of any other earth, except carbonate of magnesia, which, if present, might be mistaken for calcareous earth, but which is too rare, and occurs in proportions too small, to cause any material error in ordinary cases, and in soils of this region.

But if it be only desired to know whether calcareous earth is entirely wanting in any soil—or to test the truth of my assertion that so great a proportion of our soils are destitute of that earth—it may be done with far more ease than by either of the foregoing methods, and without apparatus of any kind. Let a handful of the soil (without drying or weighing) be thrown into a large drinking glass, containing enough of pure water to cover the soil about two inches. Stir it until all the lumps have disappeared, and the water has certainly taken the place of all the atmospheric air which the soil had enclosed. Remove any vegetable fibres, or froth, from the surface of the liquid, so as to have it clear. Then pour in gently about a table spoonful of undiluted muriatic acid, which by its greater weight will sink, and penetrate the soil, without any agitation being necessary for that purpose. If any calcareous earth is present it will quickly begin to combine with the acid, throwing off its carbonic acid in *gas*, which cannot fail to be observed as it escapes, as the gas that eight grains only of calcareous earth would throw out, would be equal in bulk to a gill measure. Indeed, the product of only a single grain of calcareous earth, would be abundantly plain to the eye of the careful operator, though it might be the whole amount of gas from two thousand grains of soil. If no effervescence is seen even after adding more acid and gently stirring the mixture, then it is absolutely certain that the soil contained not the smallest portion of carbonate of lime; nor of carbonate of magnesia, the only other substance which could possibly be mistaken for it.

The examinations of all the soils that will be here mentioned were made in this pneumatic apparatus, except some of those which evidently evolved no gas, and when no other result was required. As calcareous earth is plainly visible to the eye in all shelly soils, they only need examination to ascertain its proportion. A few examples will show what proportions we may find, and how greatly they vary, even in soils apparently of equal value.

1. Soil, a black clayey loam, from the top of the high knoll at the end of Coggins Point, on James-river, containing fragments of muscle shells throughout. Never manured and supposed to have been under scourging cultivation and close grazing from the first settlement of the country; then

(1818) capable of producing twenty-five or thirty bushels of corn—and the soil well suited to wheat. One thousand grains, cleared by a fine sieve of all coarse shelly matter, (as none can act on the soil until minutely divided,) yielded sixteen ounce measures of carbonic acid gas, which showed the finely divided calcareous earth to be thirty-two grains.

2. One thousand grains of similar soil from another part of the same field, treated in the same manner, gave twenty-four grains of finely divided calcareous earth.

3. From the east end of a small island, at the end of Coggins Point, surrounded by the river and tide marsh. Soil, dark brown loam, much lighter than the preceding specimens, though not sandy—under like exhausting cultivation—then capable of bringing thirty to thirty-five bushels of corn—not a good wheat soil, ten or twelve bushels being probably a full crop. One thousand grains yielded eight grains of coarse shelly matter, and eighty-two of finely divided calcareous earth.

4. From a small spot of sandy soil, almost bare of vegetation, and incapable of producing any grain, though in the midst of very rich land, and cleared but a few years. Some small fragments of fossil sea-shells being visible, proved this barren spot to be calcareous, which induced its examination. Four hundred grains yielded eighty-seven of calcareous earth —nearly twenty-two per cent. This soil was afterwards dug and carried out as manure.

5. Black friable loam, from Indian Fields, on York-river. The soil was a specimen of a field of considerable extent, mixed throughout with oyster shells. Though light and mellow, the soil did not appear to be sandy. Rich, durable, and long under exhausting cultivation.

1260 grains of soil yielded
168 — of coarse shelly matter, separated mechanically,
8 — finely divided calcareous earth.

The remaining solid matter, carefully separated, (by agitation and settling in water,) consisted of
130 grains of fine clay, black with putrescent matter, and which lost more than one-fourth of its weight by being exposed to a red heat,
875 — white sand, moderately fine,
20 — very fine sand,
36 — lost in the process.

1061

6. Oyster shell soil of the best quality, from the farm of Wills Cowper, Esq., on Nansemond river—never manured, and supposed to have been cultivated in corn as often as three years in four, since the first settlement of the country—now yields (by actual measurement) thirty bushels of corn to the acre—but is very unproductive in wheat. A specimen taken from the surface, to the depth of six inches, weighed altogether
242 dwt., which consisted of

126 — of shells and their fragments, separated by the sieve,
116 — remaining finely divided soil.

Of the finely divided part, 500 grains consisted of
18 grains of carbonate of lime,
330 — silicious sand—none very coarse,
94 — impalpable aluminous and silicious earth,
35 — putrescent vegetable matter—none coarse or unrotted,
23 — loss,

500

It is unnecessary to cite any particular trials of our poor soils, as it has been stated, in the preceding chapter, that all are entirely destitute of calcareous earth—excluding the rare, but well marked exceptions of its great excess, of which an example has been given in the soil marked 4, in the foregoing examinations.

Unless then I am mistaken in supposing that these facts are universally true, the certain results of chemical analysis, as well as more extended general observation, completely establish these general rules—viz.:

1*st. That all calcareous soils are naturally fertile and durable in a very high degree—and,*

2*d. That all soils naturally poor are entirely destitute of calcareous earth.*

It then can scarcely be denied that calcareous earth must be the cause of the fertility of the one class of soils, and that the want of it produces the poverty of the other. Qualities that always thus accompany each other cannot be otherwise than *cause* and *effect.* If further proof is wanting, it can be safely promised to be furnished when the practical application of calcareous manures to poor soils will be treated of, and the effects stated.

These deductions are then established as to all calcareous soils, and all poor soils—which two classes comprise nine-tenths of all. This alone would open a wide field for the practical exercise of the truths we have reached. But still there remain strong objections and stubborn facts opposed to the complete proof and universal application of the proposition now under consideration, and consequently to the theory which that proposition is intended to support. The whole difficulty will be apparent at once when I now proceed to state that nearly all of our best soils, such as are very little if at all inferior in value to the small portion of shelly lands, *are as destitute of calcareous earth (carbonate of lime) as the poorest.* So far as I have examined, this deficiency is no less general in the richest alluvial lands of the upper country—and, what will be deemed by some as incredible, by far the greater part of the rich limestone soils between the Blue Ridge and Alleghany mountains are equally destitute of calcareous earth. These facts were not named before, to avoid embarrassing the discussion of other points--nor can they now be explained, and reconciled with my proposition, except through a circuitous and apparently digressive course of reasoning. They have not been kept out of view, nor slurred over, to weaken their force, and are now presented in all their strength. These difficulties will be considered, and removed, in the following chapters.

CHAPTER VI.

CHEMICAL EXAMINATION OF RICH SOILS CONTAINING NO CALCAREOUS EARTH.

Proposition 2—continued.

Under common circumstances, when any disputant admits facts that seem to contradict his own reasoning, such admission is deemed abundant evidence of their existence. But though now placed exactly in this situation, the facts admitted by me are so opposed to all that scientific agriculturists have taught us to expect, that it is necessary for me to show the grounds on which my admission rests. Few would have believed in the absence of calcareous earth in all our poor soils, forming as they do the

much larger part of all this region--and far more strange is it that the same deficiency should extend to such rich soils as some that will be here cited.

The following specimens, taken from well known and very fertile soils, were found to contain no calcareous earth. Many trials of other rich soils have yielded like results--and, indeed, I have never found calcareous earth in any soil below the falls of the rivers, in which, or near which, some particles of shells were not visible.

1. Soil from Eppes' Island, which lies in James-river, near City Point; light and friable (but not silicious) brown loam, rich and durable. The surface is not many feet above the highest tides, and, like most of the best river lands, this tract seems to have been formed by alluvion many ages ago, but which may be termed recent, when compared to the general formation of the tide-water district.

2. Black silicious loam from the celebrated lands on Back-river, near Hampton.

3. Soil from rich land on Pocoson-river, York county.

4. Black clay vegetable soil, from a fresh-water tide marsh on James-river—formed by recent alluvion.

5. Alluvial soil of first-rate fertility above the falls of James-river—dark brown clay loam, from the valuable and extensive body of bottom land belonging to General J. H. Cocke, of Fluvanna.

The most remarkable facts of the absence of calcareous earth are to be found in the lime-stone soils, between the Blue Ridge and Alleghany mountains. Of these, I will report all that I have examined; and none contained any calcareous earth, unless when the contrary will be stated.

Before the first of these trials was made, I supposed (as probably most other persons do) that *lime-stone soil* was necessarily *calcareous*, and in a high degree. It is difficult to get rid of this impression entirely—and it may seem a contradiction in terms to say that a *lime-stone soil* is not calcareous. This I cannot avoid. I must take the term *lime-stone soil* as custom has already fixed it. But it should not be extended to any soils except those which are so near to lime-stone rock, as in some measure to be thereby affected in their qualities and value.

1 to 6. Lime-stone soils selected in the neighborhood of Lexington, Virginia, by Professor Graham, with the view of enabling me to investigate this subject. All the specimens were from first-rate soils, except one, which was from land of inferior value. One of the specimens, Mr. Graham's description stated to be "taken from a piece of land so rocky [with lime-stone] as to be unfit for cultivation, at least with the plough. I could scarcely select a specimen which I would expect to be more strongly impregnated with calcareous earth." This specimen, by two separate trials, yielded only one grain of calcareous earth, from one thousand of soil. The other five soils contained none. The same result was obtained from

7. A specimen of alluvial land on North-river, near Lexington.

8. Brown loam from the Sweet Spring valley, remarkable for its extraordinary productiveness and durability. It is of alluvial formation, and before it was drained, must have been often covered and saturated by the Sweet Spring and other mineral waters, which hold lime in solution. The surrounding high land is of lime-stone soil. Of this specimen, taken from about two hundred yards below the Sweet Spring, from land long cultivated every year, three hundred and sixty grains yielded not a particle of calcareous earth. It contained an unusually large proportion of *oxide of iron*, though my imperfect means enabled me to separate and collect only eight grains, the process evidently wasting several more.

About a mile lower down, drains were then making (in 1826) to reclaim

more of this rich valley from the overflowing waters. Another specimen was taken from the bottom of a ditch just opened, eighteen inches below the surface. It was a black loam, and exhibited to the eye some very diminutive fresh-water shells, (perriwinkles, about one tenth of an inch in length,) and many of their broken fragments. This gave, from two hundred grains, seventy-four of calcareous earth. But this cannot fairly be placed on the same footing with the other soils, as it had obviously been once the bottom of a stream, or lake, and the collection and deposite of so large and unusual a proportion of calcareous matter seemed to be of animal formation. Both these specimens were selected at my request by one of our best farmers, and who also furnished a written description of the soils, and their situation.

9. Wood-land, west of Union, Monroe county. Soil, a black clay loam, lying on, but not intermixed at the surface with lime-stone rock. Sub-soil, yellowish clay. The rock at this place, a foot below the surface. Principal growth, sugar maple, white walnut, and oak. This and the next specimen are from one of the richest tracts of high land that I have seen.

10. Soil similar to the last and about two hundred yards distant. Here the lime-stone showed above the surface, and the specimen was taken from between two large masses of fixed rock, and about a foot distant from each.

11. Black rich soil, from wood-land between the Hot and Warm Springs, in Bath county. The specimen was part of what was in contact with a mass of lime-stone.

12. Soil from the western foot of the Warm Spring mountain, on a gentle slope between the court-house and the road, and about one hundred and fifty yards from the Warm Bath. Rich brown loam, containing many small pieces of lime-stone, but no finely divided calcareous earth.

13. A specimen taken two or three hundred yards from the last, and also at the foot of the mountain. Soil, a rich black loam, full of small fragments of lime-stone of different sizes, between that of a nutmeg and small shot. The land had never been broken up for cultivation. One thousand grains contained two hundred and forty grains of small stone or gravel, mostly lime-stone, separated mechanically, and sixty-nine grains of finely divided calcareous earth.

14. Black loamy clay, from the excellent wheat soil adjoining the town of Bedford, in Pennsylvania: the specimen taken from beneath and in contact with lime-stone. One thousand grains yielded less than one grain of calcareous earth.

15. A specimen from within a few yards of the last, but not in contact with lime-stone, contained no calcareous earth; neither did the red clay sub-soil, six inches below the surface.

16. Very similar soil, but much deeper, adjoining the principal street of Bedford—the specimen taken from eighteen inches below the surface, and adjoining a mass of lime-stone. A very small disengagement of gas indicated the presence of calcareous earth—but certainly less than one grain in one thousand, and perhaps not half that quantity.

17. Alluvial soil on the Juniata, adjoining Bedford.

18. Alluvial vegetable soil near the stream flowing from all the Saratoga Mineral Springs, and necessarily often covered and soaked by those waters, and

19. Soil taken from the bed of the same stream—neither contained any portion of carbonate of lime.

Thus it appears that of these nineteen specimens of soils, only four contained calcareous earth, and three of these four in exceedingly small pro-

portions. It should be remarked that all these were selected from situations which, from their proximity to calcareous rock, or exposure to calcareous waters, were supposed most likely to present highly calcareous soils. If five hundred specimens had been taken, without choice, even from what are commonly called lime-stone soils, (merely because they are not very distant from lime-stone rock, or springs of lime-stone water,) the analysis of that whole number would be less likely to show calcareous earth, than the foregoing short list. I therefore feel justified, from my own few examinations, and unsupported by any other authority, to pronounce that calcareous earth will very rarely be found in any soils between the falls of our rivers and the navigable western waters. In a few specimens of some of the best soils from the borders of the Mississippi and its tributary rivers, I have since found calcareous earth present in all--but in very small proportions, and in no case exceeding two per cent.

When the total deficiency of carbonate of lime, in nearly all the soils of Virginia, was first asserted, as above, in the earliest publication of this essay, (1821; in *American Farmer, vol. iii.*,) the proposition was so entirely new, and so opposed to all inferences from authority then existing, that it was indispensably necessary to adduce my facts, as is done above, to sustain the otherwise unsustained doctrine. And such support, for the same reason, continued to be wanting through the two next editions. Now (in 1842) the case is altogether different. The fact of the absence of carbonate of lime, as generally as I had assumed, through the eastern or seaward slope of the United States, and especially in New England, has been confirmed by all the analyses of soils which have been since made by Professor Hitchcock and other accurate scientific investigators; and the proposition, however untenable or incredible it might have been deemed before, is now universally admitted, and indeed is placed beyond question or doubt, as an important feature in the chemical constitution of soils.

The only soils of considerable extent of surface which, from the specimens that I have examined, appear to be highly calcareous, and to agree in that respect with many European soils, are from the *prairies*, those lands of the south-west which, whether rich or poor, are remarkable for being destitute of trees, and covered with grass, so as to form natural meadows. The examinations were made but recently, (in 1834,) and are reported because presenting striking exceptions to the general constitution of soils in this country.

20. Prairie soil of the most productive kind in Alabama; a black clay, with very little sand, yet so far from being stiff, that it becomes too light by cultivation. This kind of land is stated by the friend to whom I am indebted for the specimens, to "produce corn and oats most luxuriantly—and also cotton for two or three years; but after that time cotton is subject to the rust, probably from the then open state of the soil, which by cultivation has by that time become as light and as soft as a bank of ashes." One hundred grains of the specimen contained eight of carbonate of lime. All this prairie land in Alabama lies on a substratum of what is there called "rotten lime-stone," (specimens of which contained seventy-two to eighty-two per cent. of lime,) and which rises to the surface sometimes, forming the "bald prairies," a sample of the soil of which (21) contained fifty-nine per cent. of carbonate of lime. This was described as "comparatively poor—neither trees nor bushes grow there, and only grass and weeds before cultivation—corn does not grow well—small grain better—and cotton soon becomes subject to the rust." The excessive proportion of calcareous earth is evidently the cause of its barrenness.

The substratum called lime-stone is soft enough to be cut easily and

smoothly with a knife, and some of it is in appearance and texture more like the chalk of Europe, than any other earth that I have seen in this country.

22. A specimen of the very rich "cane brake" lands in Marengo county, Alabama, contained sixteen per cent. of carbonate of lime. This is a kind of prairie, of a wetter nature, from the winter rains not being able to run off from the level surface, nor to sink through the tenacious clay soil, and the solid stratum of lime-stone below.

23. A specimen from the very extensive "Choctaw Prairie" in Mississippi, of celebrated fertility, yielded thirteen per cent. of carbonate of lime.

Several other specimens of different, but all of very fertile soils from southern Alabama, and all lying over the substratum of soft lime-stone, were found to be *neutral*, containing not a particle of lime in the form of *carbonate*. These specimens were as follows—

24. One from the valley cane land—"very wet through the winter, but always dry in summer—and after being ditched is dry enough to be cultivated in cotton, which will grow from eight to twelve feet high."

25. Another from what is called the best "post-oak land," on which trees of that kind grow to the size of from two to four feet in diameter—having but little underwood, and no cane growth—"thought to be nearly as rich as the best cane land, and will produce 1500 lbs., or more, of seed cotton, or fifty bushels of corn to the acre."

26. Another from what is termed "palmetto land, having on it that plant as well as a heavy cover of large trees growing luxuriantly. It is a cold and wet soil before being brought into good tilth; but afterwards is soft and easy to till, and produces corn and cotton finely. The cane on it is generally small: the soil from four to ten feet deep."*

One more prairie soil only will be adduced, from many analyses which have furnished general results like the foregoing, (20 to 26); and this one is given because it serves as a fair specimen of a very large class of the prairie lands. It was selected by Dr. R. W. Withers, in 1835, and described by him as follows: (*Farmers' Register, vol. iii., p.* 498.)

Soil of Greene county, Alabama, "from our open or *bald* prairie, [*i. e.*, totally without trees,] which has been cultivated for seven or eight years—produces corn very well—nearly fifty bushels to the acre are now standing on the ground; but cotton does not produce so well on it as on poor sandy soil. I feel very confident that this specimen is highly calcareous, as there are many fragments of shells mixed with the soil, and the rock is not two feet from the surface. Of all the specimens hitherto sent, this is the one which will give the nearest approach to the general character of our open prairie land in this part of the country."—This specimen was found to contain 33 per cent. of carbonate of lime.

The foregoing details, respecting lime-stone lands, may perhaps be considered an unnecessary digression, in a treatise on the soils of the tide-water district. But the analysis of lime-stone soils furnishes the strongest evi-

* It is proper to mention a circumstance which may have had some effect in removing the carbonate of lime from these Alabama soils, besides the more general causes which will be traced in the next chapter. With these specimens of soil was sent a collection of the small stones and gravel which were stated to be found generally through these soils, and particularly in the clay sub-soil beneath. Among these there were several fragments of *sulphuret of iron.* This mineral, when decomposing in the earth in contact with carbonate of lime, also decomposes the latter substance, and forms sulphate of lime, (gypsum,) instead. It is well worth inquiry whether sulphuret of iron is generally found in these soils. It may be known by its great weight, and metallic lustre when broken, (which has caused it often to be mistaken for silver ore,) and by giving out fumes of burning sulphur when subjected to strong heat under a blow pipe.

dence of the remarkable and novel fact of the general absence of calcareous earth—and the information thence derived will be used to sustain the following steps of my argument.

All the examinations of soils in this chapter concur in opposing the general application of the proposition that the deficiency of calcareous earth is the cause of the sterility of our soils. And having stated the objection in all its force, I shall now proceed to inquire into its causes, and endeavor to dispel its apparent opposition to my doctrine.

CHAPTER VII.

PROOFS OF THE EXISTENCE OF ACID AND NEUTRAL SOILS.

Proposition 2—continued.

Sufficient evidence has been adduced to prove that many of our most fertile and valuable soils are destitute of calcareous earth. But it does not necessarily follow that such has always been their composition; or that they may not now contain lime combined with some other acid than the carbonic. That this is really the case, I shall now offer proofs to establish; and not only maintain this position with regard to those valuable soils, but shall contend that *lime, in some proportion, combined with vegetable acid, is present in every soil capable of supporting vegetation.*

But while I shall endeavor to maintain these positions, without asking or even admitting any exception, let me not be understood as asserting that the original ingredient of calcareous earth was always the sole cause of the fertility of any particular soil, or that a knowledge of the proportion contained, would serve to measure the capacity of the soil for improvement. Calcareous soils, not differing materially in qualities or value, often exhibit a remarkable difference in their respective proportions of calcareous earth; so that it would seem that a small quantity, aided by some other unknown agent, or perhaps by time, may give as much capacity for improvement, and ultimately produce as much fertility, as ten times that proportion, under other circumstances.

In all naturally poor soils, producing freely pine and whortleberry in their virgin state, and sheep sorrel after cultivation, I suppose to have been formed some *vegetable acid*, which, after taking up whatever small quantity of lime might have been present, still remains in excess in the soil, and nourishes in the highest degree the plants named above, but is a poison to all useful crops; and effectually prevents such soils becoming rich, by either natural or artificial applications of putrescent manures.

In a *neutral soil*, I suppose calcareous earth to have been sufficiently abundant at some former time to produce a high degree of fertility—but that it has been decomposed, and the lime taken up, by the gradual formation of vegetable acid, until the lime and the acid neutralize and balance each other, leaving no considerable excess of either; and that such are all our fertile soils which are not now calcareous.

These suppositions remain to be proved, in all their parts.

No opinion has been yet advanced that is less supported by good authority, or to which more general opposition may be expected, than that which supposes the existence of acid soils. The term *sour soil* is frequently used by farmers, but in so loose a manner as to deserve no consideration. It has been thus applied to any cold and ungrateful land, without intending

that the term should be literally understood, and perhaps without attaching to its use any precise meaning whatever. Dundonald only, of all those who have applied chemistry to agriculture, has asserted the existence of vegetable acid in soils:* but he has offered no analysis of soils in proof, nor any other evidence to establish the fact; and his opinion has received no confirmation, nor even the slightest notice, from later and more able investigators of the chemical characters of soils. Kirwan and Davy profess to enumerate all the common ingredients of soils; and it is not intimated by either that vegetable acid is one of them. Even this tacit denial by Davy more strongly opposes the existence of vegetable acid, than it is supported by the opinion of Dundonald, or any of those writers on agriculture who have admitted its existence. For it cannot be supposed that so able and profound an investigator would have omitted all reference to an ingredient of soils so general, and therefore so important, as is here asserted, even if its presence had been ever suspected by him, much less known. Grisenthwaite, a late writer on agricultural chemistry, and who has the advantage of knowing the discoveries, and comparing the opinions, of all his predecessors, expressly denies the possibility of any acid existing in soils. His *New 'Theory of Agriculture'* contains the following passage: "Chalk has been recommended as a substance calculated to correct the sourness of land. It would surely have been a wise practice to have previously ascertained this existence of acid, and to have determined its nature, in order that it might be effectually removed. The fact really is, that no soil was ever yet found to contain any notable quantity of acid. The acetic and the carbonic are the only two that are likely to be generated by any spontaneous decomposition of animal or vegetable bodies, and neither of them have any fixity when exposed to the air." Thus, then, my doctrine is deprived of even the feeble support it might have had from Dundonald's mere opinion, if that opinion had not been contradicted by later and better authority: and the only support that I can look for, will be in the facts and arguments that I shall be able to adduce.

I am not prepared to question what Grisenthwaite states as a chemical fact, "that no soil was ever yet found to contain any notable quantity of acid." No soil examined by me for this purpose gave any evidence of the presence of uncombined acid. Still, however, the term acid may be applied with propriety to soils in which growing vegetables continually receive acid from the decomposition of others, (for which no "fixity" is requisite,) or in which acid is present, not free, but combined with some base, by which it is readily yielded to promote, or retard, the growth of plants in contact with it. It will be sufficient for my purpose to show that certain soils contain some substance, or possess some quality, which promotes almost exclusively the growth of acid plants—that this power is strengthened by adding known vegetable acids to the soil—and is totally removed by the application of calcareous manures, which would necessarily destroy any acid, if it were present. Leaving it to chemists to determine the nature and properties of this substance, I merely contend for its existence and effects; and the cause of these effects, whatever it may be, for the want of a better name, I shall call *acidity*.

The proofs now to be offered in support of the existence of acid and neutral soils, however weak each may be when considered alone, yet, when taken in connexion, will together form a body of evidence not easily to be resisted.

First proof.—Pine and common sorrel have leaves well known to be acid

* Dundonald's Connexion of Chemistry and Agriculture.

to the taste; and their growth is favored by the soils which I suppose to be acid, to an extent which would be thought remarkable in other plants on the richest soils. Except wild locust on the best river land, no growth can compare in rapidity with pines on soils naturally poor, and even greatly reduced by long cultivation. Pines usually stand so thick, on old exhausted fields, that the increase of size in each plant is greatly retarded; but if the whole growth of an acre were estimated, it would probably exceed in quantity the different growth of the richest soils, of the same age and on an equal space. Every cultivator of corn on poor light soil knows how rapidly sorrel* will cover his otherwise naked field, unless kept in check by continual tillage—and that to root it out, so as to prevent the like future labor, cannot be effected by any mode of cultivation whatever. This weed too is considered far more hurtful to growing crops, than any other of equal size. Yet neither of these acid plants can thrive on the best lands. Sorrel cannot even live on a calcareous soil; and if a pine is sometimes found there, it has nothing of its usual elegant form, but seems as stunted and ill-shaped as if it had always suffered for want of nourishment. Innumerable facts, of which these are examples, prove that these acid plants must derive from their favorite soil some kind of food peculiarly suited to their growth, and quite useless, if not hurtful, to cultivated crops.

2*nd.* Dead acid plants are the most effectual in promoting the growth of living ones. When pine leaves are applied to a soil, whatever acid they contain is of course given to that soil, for such time as circumstances permit it to retain its form, or peculiar properties. Such an application is often made on a large scale, by cutting down the second growth of pines, on land once under tillage, and suffering them to lie a year before cleaning and cultivating the land. The invariable consequence of this course is a growth of sorrel, for one or two years, so abundant and so injurious to the crops, as to more than balance any benefit derived by the soil from the vegetable matter having been allowed to rot. From the general experience of this effect, most persons put pine land under tillage as soon as cut down, after carefully burning (to destroy) the whole of the heavy cover of leaves, both green and dry. Until within a few years, it was generally supposed that the leaves of pine were worthless, if not hurtful, in all applications to cultivated land—which opinion doubtless was founded on such facts as have been just stated. But if they are used as litter for cattle, and heaped to ferment, the injurious quality of pine leaves is destroyed, and they become a valuable manure. This practice is but of recent origin—but is highly approved, and rapidly extending. Still later it has been found that when these leaves are applied unrotted, as raked up in wood-land, to calcareous land, they produce only and always beneficial results; and that this is the best as well as cheapest mode of their application.

On one of the washed and barren declivities (or *galls*) which are so numerous on all our farms, I had the small gullies packed full of green pine bushes, and then covered with the earth drawn from the equally barren intervening ridges, so as nearly to smooth the whole surface. The whole piece had borne nothing previously except a few scattered tufts of poverty grass, and dwarfish sorrel, all of which did not prevent the spot seeming quite bare at mid-summer, if viewed at the distance of one hundred yards. This operation was performed in February or March. The land was not

* Sheep sorrel, or *Rumex acetosa*. The wood sorrel (*Oxalis acetocella*) is of a very different character. The latter prefers rich and even calcareous soils, and I have seen it growing well on places calcareous to excess. It would seem, therefore, that wood sorrel forms its acid from the atmosphere, and does not draw it from the soil, as I suppose to be the case with common sorrel.

cultivated, nor again observed, until the second summer afterwards. At that time, the piece remained as bare as formerly, except along the filled gullies, which, throughout the whole of their crooked courses, were covered by a thick and uncommonly tall growth of sorrel, remarkably luxuriant for any situation, and which, being bounded exactly by the width of the narrow gullies, had the appearance of some vegetable sown thickly in drills, and kept clean by tillage. So great an effect of this kind has not been produced within my knowledge--though facts of like nature, and leading to the same conclusion, are of frequent occurrence. If small pines standing thinly over a broom-grass old-field are cut down and left to lie, under every top will be found a patch of sorrel, before the leaves have all rotted.

3rd. The growth of sorrel is not only peculiarly favored by the application of vegetables containing acids already formed, but also by such matters as will form acid in the course of their decomposition. Farm-yard manure, and all other putrescent animal and vegetable substances, form *acetic acid* as their decomposition proceeds.* If heaps of rotting manure are left without being spread, in a field but very slightly subject to produce sorrel, a few weeks of growing weather will bring out that plant close around every heap; and for some time the sorrel will continue to show more benefit from that rank manuring than any other grass. For several years my winter-made manure was spread and ploughed in on land not cultivated until the next autumn, or the spring after. This practice was founded on the mistaken opinion, that it would prevent much of the usual exposure to evaporation and waste of the manure. One of the reasons which alone would have compelled me to abandon this absurd practice was, that a crop of sorrel always followed, (even on good soils that before barely permitted a scanty growth of it to live,) which so injured the next grain crop as greatly to lessen the benefit from the manure. Sorrel unnaturally produced by such applications does not infest the land longer than until we may suppose the acid to have been removed by cultivation and other causes.

It may be objected, that even if fully admitted, my authorities prove only the formation of a single vegetable acid in soil, the acetic—that my facts show only the production of a single acid plant, sorrel—and that the acid which sorrel contains is not the acetic, but the oxalic.† In reply to such objections, it may be said, that from the application of acids to recently ploughed land, no acid plant except sorrel is made to grow, because that one only can spring up speedily enough to arrest the fleeting nutriment. Poverty grass (*Aristida gracilis* or *A. dichotoma*) grows only on the same kinds of soil, and generally covers them after they have been a year free from a crop, but does not show sooner; and pines require two years before their seeds will produce plants. But when pines begin to spread over the land, they soon put an end to the growth of all other plants, and are abundantly supplied with their acid food, from the dropping of their own leaves. Thus they may be first supplied with the vegetable acid ready formed in the leaves, and afterwards with the acetic acid formed by their subsequent slow decomposition. It does not weaken my argument that the product of a plant is a vegetable acid different from the one supposed to have nourished its growth. All vegetable acids (except the prussic) however different in their properties, are composed of the same three elementary bodies, differing only in their proportions‡—and consequently are all convertible into each other. A little more, or a little less of one or the other of these

* Agr. Chem. p. 187. (Phil. ed.)
† Agr. Chem. Lecture 3.
‡ Carbon, oxygen, and hydrogen. Agr. Chem. Lecture 3, p. 78.

ingredients, may change the acetic to the oxalic acid, and that to any other. We cannot doubt but that such simple changes may be produced by the chemical powers of vegetation, when others are effected far more difficult for us to comprehend. The most tender and feeble organs, and the mildest juices, aided by the power of animal or vegetable life, are able to produce decompositions and combinations which the chemist cannot explain, and which he would in vain attempt to imitate.

4th. This ingredient of soils, which nourishes acid plants, also poisons cultivated crops. Plants have not the power of rejecting noxious fluids, but take up by their roots every thing presented in a soluble form.* Thus the acid also enters the sap-vessels of cultivated plants, stints their growth, and makes it impossible for them to attain that size and perfection which their proper food would ensure, if it were presented to them without its poisonous accompaniment. When the poorest virgin wood-land is cut down, it is covered and filled to excess with leaves and other rotted and rotting vegetable matters. Can a heavier vegetable manuring be desired? And as this completely rots during cultivation, must it not offer to the growing plants as abundant a supply of food as they can require? Yet the best product obtained may be from ten to fifteen bushels of corn, or five or six of wheat, soon to come down to half those quantities. If the noxious quality which causes such injury is an acid, it is as certain as any chemical truth whatever, that it will be neutralized, and its powers destroyed, by applying enough of calcareous earth to the soil; and precisely such effects are found whenever that remedy is tried. On land thus relieved of this unceasing annoyance, the young plants of corn no longer appear of a pale and sickly green, approaching to yellow, but take immediately a deep healthy color, by which it may readily be distinguished from any on soil left in its former state, before there is any perceptible difference in the size of the plants. The crop will produce fifty to one hundred per cent. more, the first year, before its supply of food can possibly have been increased; and the soil is soon found not only cleared of sorrel, but absolutely incapable of producing it. I have anticipated these effects of calcareous manures, before furnishing the evidence; but they will hereafter be established by facts beyond contradiction.

The truth of the existence of either acid or neutral soils depends on the existence of the other; and to prove either, will necessarily establish both. If acid exists in soils, then whenever it meets with calcareous earth, the two substances must combine with and neutralize each other, so far as their proportions are properly adjusted. On the other hand, if I can show that compounds of lime and vegetable acid are present in most soils, it follows inevitably that nature has provided means by which soils can generally obtain this acid; and if the amount formed can balance the lime, the operation of the same causes can exceed that quantity, and leave an excess of free acid. From these premises will be deduced the following proofs.

5th. It has been stated (page 36) that the process recommended by chemists for finding the calcareous earth in soils was unfit for that purpose, because *some precipitate* was always obtained, even when no calcareous earth or carbonate of lime was present. Frequent trials have shown me that this precipitate is considerably more abundant from good soils than bad. The substance thus obtained from rich soils by solution and precipitation, in every case that I have tried, contains some carbonate of lime, although the soil from which it was derived had none. The alkaline liquor from which the precipitate has been separated, we are told by Davy, will, after

* Agr. Chem. Lecture 6, page 186.

boiling, let fall the carbonate of magnesia, if any had been in the soil; but when any notable deposite is thus obtained, it will often be found to consist more of carbonate of lime, than of magnesia. The following are examples of such products:

One thousand grains of tide-marsh soil, (page 40, No. 4,) acted on by muriatic acid in the pneumatic apparatus, gave out no carbonic acid gas, and therefore could have contained no carbonate of lime. The precipitate obtained from the same weighed sixteen grains; which being again acted on by sulphuric acid, evolved as much gas as showed that three grains had become carbonate of lime, in the previous part of the process.

Two hundred grains of alluvial soil from Saratoga Springs (page 41 No. 18,) containing no carbonate of lime, yielded a precipitate of twelve grains, of which three was carbonate of lime—and a deposite from the alkaline solution weighing six grains, four of which was carbonate of lime.

Seven hundred grains of limestone soil from Bedford, Pennsylvania, (part of the specimen marked 14, page 41,) contained about two-thirds of a grain of carbonate of lime—and its precipitate of twenty-eight grains, only yielded two grains: but the alkaline solution deposited eleven grains of the carbonates of lime and magnesia, of which at least five was of the former, as there remained seven and a half of solid matter, after the action of sulphuric acid.*

From this process, there can be no doubt but that the soil contained a proportion of some *salt of lime*, (or lime combined with some kind of acid,) which being decomposed by and combined with the muriatic acid, was then precipitated, not in its first form, but in that of carbonate of lime—it being supplied with carbonic acid from the carbonate of potash used to produce the precipitation. The proportions obtained in these cases were small; but it does not follow that the whole quantity of lime contained in the soil was found. However, to the extent of this small proportion of lime, is proved clearly the presence of enough of some acid (and that not the carbonic) to combine with it. Neither could it have been the sulphuric, or the phosphoric acid; for though both the sulphate and phosphate of lime are in some soils, yet neither of these salts can be decomposed by muriatic acid.

6th. The strongest objection to the doctrine of neutral soils is, that, if true, the salt formed by the combination of the lime and acid must often be present in such large proportions, that it is scarcely credible that its presence and nature should not have been discovered by any of the able chemists who have analyzed soils. This difficulty I cannot remove, but it may be met (or neutralized, to borrow a figure from my subject,) by showing that an equal difficulty awaits those who may support the other side of the argument.

The theory of geologists of the formation of soils, from the decomposi-

* The measurement of the carbonic acid gas evolved was relied on to show the whole amount of *carbonates* present—and sulphuric acid was used to distinguish between lime and magnesia, in the deposite from the alkaline solution. If any alumina or magnesia had made part of the solid matter exposed to diluted sulphuric acid, the combinations formed would have been soluble salts, which would of course have remained dissolved and invisible in the fluid. Lime only, of the four earths, forms with sulphuric acid a substance but slightly soluble, and which therefore can be mostly separated in a solid form. The whole of this substance (sulphate of lime) cannot be obtained in this manner, as a part is always dissolved; but whatever is obtained, proves that at least two-thirds of that quantity of carbonate of lime had been present; as that quantity of lime which will combine with enough carbonic acid to make 100 parts (by weight) of carbonate of lime, will combine with so much more of sulphuric acid, as to form about 150 parts of the sulphate of lime, or gypsum.

tion or disintegration of rocks, is received as true by scientific agriculturists. The soils thus supposed to be formed, receive admixtures from each other, by means of different operations of nature, and after being more or less enriched by the decay of their own vegetable products, make the endless variety of existing soils.* But where a soil, lying on and thus supposed to have been formed from any particular kind of rock, is so situated that it could not have been moved, or received considerable accessions from torrents or other agents, then, according to this theory, the rock and the soil should be composed of the same materials; and such soils as the specimens, marked 11 and 16, (page 41,) would be, like the rock they touched, nearly pure calcareous earth, instead of being (as they were in truth) destitute, or nearly so, of that ingredient. Such are the doctrines received and taught by Davy, or the unavoidable deductions from them. But, without contending for the full extent of this theory of the formation of soils, (because I consider it almost entirely false,) every one must admit that soils thus situated must have received, in the lapse of ages, some accessions to their bulk, from the effects of frost, rain, sun, and air, on the lime-stone in contact with them. All lime-stone soils, properly so called, exhibit certain marked and peculiar characters of color, texture, and products, which can only be derived from receiving into their composition more or less of the rock which lies beneath, or rises above their surface. This mixture will not be denied by any one who has observed lime-stone soils, and reasons fairly, whether his investigation begins with the causes, or their effects. If then all this accession of calcareous earth remains in the soil, why is it that none, or almost none, is discovered by accurate chemical analysis? Or, if it be supposed not present, nor yet changed in its chemical character, in what possible manner could a ponderous and insoluble earth have made its escape from the soil? To remove this obstacle, without admitting the operation of acid in making such soils neutral, will be attended with at least as much difficulty, as any arising from that admission being made.

7th. But we are not left entirely to conjecture that soils were once more calcareous than they now are, if chemical tests can be relied on to furnish proof. Acid soils that have received large quantities of calcareous earth as manure, after some time, will yield very little when analyzed. To a soil of this kind, full of vegetable matter, I applied, in 1818 and 1821, fossil shells at such a known and heavy rate as would have given to the soil (by calculation) at least three per cent. of calcareous earth, for the depth of five inches. Only a small portion of the shelly matter was very finely divided when applied. Since the application of the greater part of this dressing, (only one-fourth having been laid on in 1818,) no more than six years had passed before the following examinations were made (at end of 1826); and the cultivation of five crops in that time, three of which were horse-hoed, must have well mixed the calcareous earth with the soil. Three careful examinations gave the following results:

No. 1.—1000 grains yielded $7\frac{1}{2}$ of coarse calcareous earth, (fragments of shells,)

And less than $\frac{1}{2}$ of finely divided.

8

* Agr. Chem. p. 131. Also Treatise on Agriculture, (by General Armstrong,) quoted in a preceding page (33) of this essay.

No. 2.—1000 grains yielded 5 of coarse,
2 finely divided.

7

No. 3.—1500 grains yielded 15 of coarse,
$2\frac{1}{2}$ finely divided.

$17\frac{1}{2}$

The specimens, No. 1 and No. 2, were obtained by taking handfuls of soil from several places, (four in one case, and twelve in the other,) mixing them well together, and then taking the samples for trial from the two parcels. On such land, when not recently ploughed, there will always be an over proportion of the pieces of shells on the surface, as the rains have settled the fine soil, and left exposed the coarser matters. On this account, in making these two selections, the upper half-inch was first thrown aside, and the handful dug from below. No. 3 was taken from a spot showing a full average thickness of shells, and included the surface. I considered the three trials made as fairly as possible, to give a general average. Small as is the proportion of finely divided calcareous earth exhibited, it must have been increased by rubbing some particles from the coarser fragments, in the operation of separating them by a fine sieve. Indeed it may be doubted whether any proportion remained very finely divided—or in other words, whether it had not been combined with acid, as fast as it was so reduced. But without the benefit of this supposition, the finely divided calcareous earth in the three specimens averaged only one and one-fourth grains to the thousand, which is one twenty-fourth of the quantity laid on; and the total quantity obtained, of coarse and fine, is eight grains in one thousand, or about one-fourth of the original proportion. All the balance had changed its form, or otherwise disappeared, in the few years that had passed since the application.

Another similar trial of this soil from the same ground was repeated in July, 1842, which showed that the finely divided *carbonate* of lime, then remaining, was in quantity so small as to be barely perceptible and appreciable. The land had then remained undisturbed by tillage for nine months; and some scattered fragments of shells were exposed to view on the surface generally. For the obvious reasons stated in the preceding paragraph, there will always appear an over-proportion of such fragments, upon the surface of land not recently ploughed; for this reason, as on two of the three former trials, the upper half-inch of surface soil was thrown aside, and the sample for examination taken immediately below. Of this, 2400 grains yielded two grains only of small fragments of shells, and less than one grain of finely divided carbonate of lime; whereas seventy-two grains had been the original quantity furnished to the soil. This result, with those of the earlier trials, agree precisely with what would be expected from the action of acid in soil, and cannot be satisfactorily explained by any other doctrine.*

* Even of this very small amount of fragments of shells found, (2 grains,) more than half was of the very hard gray shells (oyster and scallop,) which seem almost indestructible in soil. They must contain some chemical ingredient which enables them to withstand the acid or other corroding action of soil, to which all the white fossil shells, whether hard or soft, so readily yield in the course of time. I recently observed a most striking proof of this well known general fact of the long durability of these gray shells, and consequently their comparative worthlessness as a manure. On like soil to the subject of the above trials, and near the same spot, I recently (1842) found a small

The very small proportions of finely divided calcareous earth compared to the coarse, in some shelly soils, furnish still stronger evidence of this kind. Of the York river soil, (described page 38 No. 5,)

1260 grains, yielded of coarse calcareous parts, - -	168 grains.
And of finely divided, - - - - - -	8
1044 of the rich Nansemond soil, (No. 6,) - - -	544 coarse.
	18 fine.

As many of the shells and their fragments in these soils are in a mouldering state, it is incredible that the whole quantity of finely divided particles derived from them should have amounted to no more than these small proportions. Independent of the action of natural causes, the plough alone, in a few years, must have pulverized at least as much of the shells as was found.

8. In other cases, where the operations of nature have been applying calcareous earth for ages, none now remains in the soil; and the proof thence derived is more striking than any obtained from artificial applications of only a few years' standing. Valleys, subject to be frequently flooded and saturated by the water of lime-stone streams, must necessarily retain a new supply of calcareous earth from every such soaking and drying. Lime-stone water contains the *super-carbonate of lime*, which is soluble; but this loses its excess of carbonic acid when left dry by evaporation, and becomes the carbonate of lime, which not being soluble, is in no danger of being removed by subsequent floods. Thus, accessions are slowly but continually made, through many centuries. Yet such soils are found containing no calcareous earth—of which a remarkable example is presented in the soil of the cultivated part of the Sweet Spring Valley, (No. 8, page 40.)

The excess of carbonic acid, which unites with lime and renders the compound soluble in water, is lost by exposure of the calcareous water to the air, as well as by evaporation to dryness. [*Accum's Chemistry*—Lime.] The masses of soft calcareous rock which are deposited in the rapids of lime-stone streams are examples of the loss of carbonic acid from exposure to the air; and the stalactites in caves, the deposite of the slow-dropping water holding in solution the super-carbonate of lime, are examples of the same effect produced by evaporation. A similar deposite of insoluble carbonate of lime, from both these causes, is necessarily made on all land subject to be flooded by lime-stone waters.

9. All *wood ashes* contain salts of lime, (and most kinds in large proportions,) which could have been derived from no other source than the soils on which the trees grew. The lime thus obtained is principally combined with carbonic acid, and partly with the phosphoric, forming phosphate of lime. The table of Saussure's numerous analyses of the ashes of numerous plants,* is sufficient to show that these products are general, if not universal. The following examples of some of my own few examinations prove that ashes yield calcareous earth in proportions suitable to their kind, although the wood grew on soils destitute of that ingredient—as was ascertained with regard to each of these soils.

and thin but well-marked oyster-shell, (*Ostrea Virginiana*,) apparently as perfect and as well preserved as when it was dug up, and which was a good characteristic specimen of the kind, and as such, has been placed in my cabinet. This shell was part of the dressing spread upon the field for the crop of 1821, and has been since exposed to all the vicissitudes of tillage and of weather for nearly twenty-two years.

* Quoted in Agr. Chem. Lecture 3.

100 GRAINS OF ASHES FROM	WHAT SOIL TAKEN FROM.	CARBONATE OF LIME.	PHOSPHATE OF LIME.
Whortleberry bushes, the entire plants, except the leaves,	Acid silicious loam,	4 grains.	4 grains.
Equal parts of the bark, heart, and sap-wood of an old locust,	The same.	51 "	18 "
Young locust bushes entire	Rich neutral clay loam,	40 "	30 "
Young pine bushes,	Acid silicious loam,	9 "	6 "
Body of a young pine tree,	Acid clay soil,	14 "	18 "

The potash was first carefully taken out of all these samples. The remaining solid matter was silicious sand and charcoal; the proportion of the latter varying according to the degree of heat used in burning the wood, which was not permitted to be very strong, for fear of converting the calcareous earth into quick-lime.

It must be evident and unquestionable that all the carbonate of lime yielded by the ashes had been necessarily furnished in some form by the soil on which the plants grew; and when the soil itself contained no carbonate, as in all these cases, some other compound of lime must have been present, to enable us to account for these certain and invariable results. The presence of a combination of lime with some *vegetable* acid, and none other, would serve to produce such effects. According to established chemical laws, if any such combination had been taken up into the sap-vessels of the tree, it would be decomposed by the heat necessary to convert the wood to ashes; the acid would be reduced to its elementary principles, and the lime would immediately unite with the carbonic acid, (which is produced abundantly by the process of combustion,) and thus present a product of *carbonate of lime* newly formed from the materials of the other substances decomposed.*

On the foregoing facts and deductions, I am content to rest the truth of the existence of acid and neutral soils.

I have chosen to leave all the preceding part of this chapter (with the exception of a few merely verbal corrections and alterations) precisely as it appeared in the first edition of this essay, (January 1832.)† But since that time I have first heard of a discovery, and of consequent investigations by men of science, which seem to furnish direct proof of what I have been contending for, viz.: *the existence of a vegetable acid substance in soils and manures, generally diffused, and often in large proportions, and yet which had not been known or suspected by chemists previously.* The first intimation of this discovery which reached me was in the '*Alphabet of Scientific Gardening*,' by Professor Rennie, published in London in 1833, from which the part relative to this subject will be quoted below. Since, I have seen the French version of the late work of Berzelius, in which his views of humic acid (or, as he names it, the geic acid,) are given more at

* The reasoning on the presence of the carbonate of lime found in ashes, from acid soils, does not apply to the phosphate of lime which is also always present. The latter salt is not decomposed by any known degree of heat, [Art. *Chemistry, in Edin. Ency.*] and therefore might possibly have remained unchanged, in passing from the soil to the tree, and thence to the ashes.

† The general position and views taken as to acid and neutral soils are also, in substance and purport, just as they appeared in my first publication on this subject in 1821.

length, and from which an extract will be translated and given in the appendix. The facts respecting humic acid, as concisely stated in the following quotation from Professor Rennie, furnish strong confirmation of some of the opinions which I have endeavored to maintain. It will however be left, without farther comment, for the reader to observe the accordance, and to make the application.

"*Humic acid and humin.*—In most chemical books the terms *ulmic acid* and *ulmin* are used, from *ulmus*, elm; but, as its substance occurs in most, if not all plants, the name is bad. I prefer Sprengel's terms, from *humus*, soil.

"This important substance was first discovered by Klaproth, in a sort of gum from an elm; but it has since been found by Berzélius in all barks; by M. Braconnot in saw-dust, starch, and sugar; and, what is still more interesting for our present purpose, it has been found by Sprengel and M. Polydore Boullay to constitute a leading principle in soils and manures. *Humin* appears to be formed of carbon and hydrogen, and the *humic acid* of humin and oxygen. Pure humin is of a deep blackish brown, without taste or smell, and water dissolves it with great difficulty and in small quantities; consequently it cannot, when pure, be available as food for plants.

"Humic acid however, which, I may remark, *is not sour to the taste*, readily combines with many of the substances found in soils and manures, and not only renders them, but itself also, easy to be dissolved in water, which in their separate state could not take place. In this way *humic acid will combine with lime, potass, and ammonia, in the form of humates, and the smallest portion of these will render it soluble in water and fit to be taken up by the spongelets of the root fibres.*

"It appears to have been from ignorance of the important action of the humic acid in thus helping to dissolve earthy matters, that the older writers were so puzzled to discover how lime and potass got into plants; and it seems also to be this, chiefly, which is so vaguely treated of in the older books, under the names of *extractive, vegetable extract, mucilaginous matter*, and the like. Saussure, for instance, filled a vessel with turf, and moistened it thoroughly with pure water, when by putting ten thousand parts of it by weight under a heavy press, and filtering and evaporating the fluid, he obtained twenty-six parts of what he termed *extract;* from ten thousand parts of well dunged and rich kitchen garden mould, he obtained ten parts of *extract;* and from ten thousand parts of good corn field mould, he obtained four parts of *extract.*

"M. Polydore Boullay found that the liquid manure, drained from dung-hills, contains a large proportion of humic acid, which accounts for its fertilizing properties so well known in China and on the continent; and he found it also in peat earth, and in varying proportions in all sorts of turf. It appears probable, from Gay-Lussac having found a similar acid, (technically *azumic acid,*) on decomposing the prussic acid, (technically *hydrocyanic acid,*) that the humic acid may be found in animal blood, and if so, it will account for its utility as a manure for vines, &c. Dobereiner found the gallic acid convertible into the humic."

When the last edition of this essay was published, (in 1835,) the above annunciation had but just before been made, showing that there was indeed high scientific authority for the very general existence of a vegetable acid in soils. And since that time, the fact has been admitted by almost all scientific writers, and has been treated of at length in sundry chemical works and reports of geological surveys in this country. The doctrine of the existence of an acid of soil, of vegetable origin, which before had scarcely any other authority for its support than mine, humble and obscure as that was,

is now of universal acceptation. Still, notwithstanding all that has been written on the subject, very little light has been thrown on it by the chemists who have treated of it. Being myself too little informed to be able to properly digest these different speculations and to balance authorities, and to separate the true and valuable from the erroneous or worthless of what has been lately published, I deem it best still to rely on my own previously published views and proofs only, as presented in the foregoing pages. Therefore, leaving it to chemists to settle their present differences of opinion in regard to the qualities, and even identity, as well as name of the acid of soil, and to clear away the existing confusion and obscurity of their views, I will, for the present, adopt nothing on their authority in this respect. Still, I earnestly hope that their subsequent investigations may be successful in eliciting and determining what is true of this acid—and also in applying the truths ascertained to advance the knowledge of the composition and improvement of soils. For the same reason, I shall also decline adopting any of the various terms which have been successively applied by different, and even the same chemists, to designate the *acid of soil;* as *humic, geic, crenic* and *apocrenic acid*, &c.

But without the aid of this recent discovery of the humic or geic acid, if the foregoing examinations of soils, and the arguments which follow, remain unquestioned, these two remarkable and important facts may be considered as thereby established beyond dispute or doubt:

1st, That calcareous earth, or carbonate of lime, is in general as entirely deficient in the soils of Virginia, as that ingredient had heretofore been supposed, by agricultural writers, to be common in all soils; and,

2d, That, notwithstanding this total absence of the carbonate of lime, that lime in some other form of combination, and in greater or less quantity, is an ingredient of every soil capable of producing vegetation.

Nor do these facts come in conflict with each other; nor either of them with the position which has been contended for, that calcareous matter in proper proportions is necessary to cause fertility in soils. Should some other person, who may be aided by sufficient scientific light, undertake the investigation, he may supply all that is wanting for the direct proof of this theory of the cause of fertility, and perhaps show that the value of a soil (under equal circumstances) is in proportion to the quantity of the *vegetable salt of lime* present in the soil. The direct and positive proof of this doctrine, I confidently anticipate will hereafter be obtained from more full examinations of the humic acid, and its compounds in various soils, and from correct and minute reports of the quantities and kinds of those ingredients, in connexion with the degree of the natural fertility of each soil. As yet, however interesting the recent discovery of humic acid may be to chemists, it does not seem that they have suspected it to have any thing like the important bearing on the fertilization of soil which I had attributed to the supposed acid principle or ingredient of soils. Berzelius seems scarcely to have bestowed a thought on this most important application of his investigation of the properties of geine and geic acid.

Supposing the doctrine to be sufficiently established by my own proofs offered above, it may be useful to trace the formation and increase of acidity in different soils, according to the views which have been presented, and to display the promise which that quality holds out for improving those soils which it has heretofore rendered barren and worthless.

Every neutral soil at some former time must have contained calcareous earth in sufficient quantity to produce the uniform effect of that ingredient of storing up and fixing fertility. The decomposition of the successive growths of plants, left to rot on the rich soil, continually formed vegetable acid, which,

as fast as formed, united with the lime in the soil. At last these two principles balanced each other, and the soil was no longer calcareous, but neutral. Instead of its former ingredient, *carbonate of lime*, it was now supplied with a *vegetable salt of lime*. This change of soil does not affect the natural growth, which remains the same, and thrives as well as when the soil was calcareous; and when brought into cultivation, the soil is equally productive under all crops suited to calcareous soils. If the supplies of vegetable matter continue, the soil may even become acid in some measure, as may be evidenced by the growth of sorrel—but without losing any of its fertility before acquired. The degree of acidity in any one soil frequently varies; it is increased by the growth of such plants as delight to feed on it, and by the decomposition of all vegetable matters. Hence the longer a poor field remains at rest, and not grazed, the more acid it becomes; and this evil keeping pace with the benefits derived, is the cause why so little improvement, or increased product, is obtained from putting acid soils under that mild treatment. Cultivation not only prevents new supplies, but also diminishes the acidity already present in excess, by exposing it to the atmosphere; and therefore the more a soil is exhausted, the more will its acidity be lessened.

We have seen from the proof furnished by the analysis of wood ashes, that even poor acid soils contain a little salt of lime, and therefore must have been slightly calcareous at some former time. But such small proportions of calcareous earth were soon equalled, and then exceeded, by the formation of vegetable acid, before much productiveness was caused. The soil being thus changed, the plants suitable to calcareous soils died off, and gave place to others which produce, as well as feed and thrive on, acidity. Still, however, even these plants furnish abundant supplies of vegetable matter, sufficient to enrich the land in the highest degree; but the antiseptic power of the acid prevents the leaves from rotting for years, and even then the soil has no power to profit by their products. Though continually wasted, the vegetable matter is continually again forming, and always present in abundance; but must remain almost useless to the soil, until the accompanying acidity shall be destroyed.

It may well be doubted whether any soil destitute of lime in every form would not necessarily be a perfect barren, incapable of producing a spire of grass. No soil thus destitute is known, as the plants of all soils show in their ashes the presence of some lime. But it is probable that our sub-soils, which, when left naked by the washing away of the soil, are so generally and totally barren, are made so by their being entirely destitute of lime in any form. There is a natural process regularly and at all times working to deprive the sub-soil of all lime, unless the soil is abundantly supplied. What constitutes soil, and makes the strong and plain mark of separation and distinction between the more or less fertile soil and the absolutely sterile sub-soil beneath? The most obvious cause for this difference which might be stated, is the dropping of the dead vegetable matter on the surface; but this is not sufficient alone to produce the effects, though it may be so when aided by another cause of more power. When the most barren surface earth was formed or deposited by any of the natural agents to which such effects are attributed by geologists, it seems reasonable to suppose that the surface was no richer than any lower part of the whole upper stratum so deposited. If, then, a very minute proportion of lime had been equally distributed through the body of poor earth to any depth that the roots of trees could penetrate, it would follow that the roots would, in the course of time, take up all the lime, as all of it would be wanting for the support of the trees; and their death and decay would afterwards leave

all this former ingredient of the soil in general, on the surface. This process must have the effect, in the course of time, of fixing on and near the surface the whole of a scanty supply of lime, and of leaving the sub-soil without any. But if there is within the reach of the roots more lime than any one crop or growth of plants needs, then the superfluous lime will be permitted to remain in the sub-soil, which sub-soil will then be improvable by vegetable substances, and readily convertible to productive soil. The manner in which lime thus operates will be explained in the next chapter.

Nearly all the wood-land now remaining in lower Virginia, and also much of the land which has long been arable, is rendered unproductive by acidity, and successive generations have toiled on such land, almost without remuneration, and without suspecting that their worst virgin land was then richer than their manured lots appear to be. The cultivator of such soil, who knows not its peculiar disease, has no other prospect than a gradual decrease of his always scanty crops. But if the evil is once understood, and the means of its removal is within his reach, he has reason to rejoice that his soil was so constituted as to be preserved from the effects of the improvidence of his forefathers, who would have worn out any land not almost indestructible. The presence of acid, by restraining the productive powers of the soil, has in a great measure saved it from exhaustion; and after a course of cropping which would have utterly ruined soils much better constituted, the powers of our acid land remain not greatly impaired, though dormant, and ready to be called into action by merely being relieved of its acid quality. A few crops will reduce a new acid field to so low a rate of product, that it scarcely will pay for its cultivation; but no great change is afterwards caused, by continuing scourging tillage and grazing, for fifty years longer. Thus our acid soils have two remarkable and opposite qualities, both proceeding from the same cause: they can neither be enriched by manure, nor impoverished by cultivation, to any great extent. Qualities so remarkable deserve all our powers of investigation; yet their very frequency seems to have caused them to be overlooked; and our writers on agriculture have continued to urge those who seek improvement to apply precepts drawn from English authors, to soils which are totally different from all those for which their instructions were intended.

CHAPTER VIII.

THE MODE OF OPERATION BY WHICH CALCAREOUS EARTH INCREASES THE FERTILITY AND PRODUCTIVENESS OF SOILS.

PROPOSITION 3. *The fertilizing effects of calcareous earth are chiefly produced by its power of neutralizing acids, and of combining putrescent manures with soils, between which there would otherwise be but little, if any, chemical attraction.*

PROPOSITION 4. *Poor and acid soils cannot be improved durably, or profitably, by putrescent manures, without previously making them calcareous, and thereby correcting the defect in their constitution.*

It has already been made evident that the presence of calcareous earth in a natural soil causes great and durable fertility. But it still remains to be determined, to what properties of this earth its peculiar fertilizing effects are to be attributed.

Chemistry has taught that silicious earth, in any state of division, attracts but slightly, if at all, any of the parts of putrescent animal and vegetable matters.* But even if any slight attraction really exists when this earth is minutely divided for experiment in the laboratory of the chemist, it cannot be exerted by silicious sand in the usual form in which nature gives it to soils; that is, in particles comparatively coarse, loose, and open, and yet each particle impenetrable to any liquid, or gaseous fluid, that might be passing through the vacancies. Hence, silicious earth can have no power, chemical or mechanical, either to attract enriching manures, or to preserve them when actually placed in contact and intermixed with them; and soils in which the qualities of this earth greatly predominate, must give out freely all enriching matters which they may have received, not only to a growing crop, but to the sun, air, and water, so as soon to lose the whole. No portion of putrescent matter can remain longer than the completion of its decomposition; and if not arrested during this process, by the roots of living plants, all will escape in the form of *gas* (the latest products of decomposition,) into the air, without leaving a trace of lasting improvement. With a knowledge of these properties, we need not resort to the common opinion that manure *sinks* through sandy soils, to account for its rapid and total disappearance.†

Aluminous earth, by its closeness, mechanically excludes those agents of decomposition, heat, air and moisture, which sand so freely admits; and therefore clay soils, in which this earth predominates, give out manure much more slowly than sand, whether for waste or for use. The practical effect of this is universally understood—that clay soils retain manure much longer than sand, but require much heavier applications to show as much effect early, or at once. But as this means of retaining manure is altogether mechanical, it serves only to delay both its use and its waste. Aluminous earth also exerts some chemical power in attracting and combining with putrescent manures, but too weakly to enable a clay soil to become rich by natural means. For though clays are able to exert more force than sand in holding manures, their closeness also acts to deny admittance beneath

* Davy's Agr. Chem. page 129.

† Except the very small proportions of earthy, saline and metallic matters that may be in animal and vegetable manures, the whole balance of their bulk (and the whole of whatever can feed plants,) is composed of different elements which are known only in the forms of *gases*—into which manures must be finally resolved, after going through all the various stages of fermentation and decomposition. So far from sinking in the earth, these final results could not be possibly confined there, but must escape into the atmosphere as soon as they take a gaseous form, unless immediately taken up by the organs of growing plants. It is probable that but a small portion of any dressing of manure remains long enough in the soil to make this final change; and that nearly all of it is used by growing plants, during previous changes, or carried off by air and water. During the progress of the many changes caused by fermentation and decomposition, every soluble product may certainly sink as low as the rains penetrate; but it cannot descend lower than the water, and that, together with the soluble manure, will be again drawn up by the roots of plants. One exception, however, seems probable. Should the soil need draining, to take off water passing beneath the surface, the soluble manure may be carried off by those springs; and this supposed result receives strong confirmation from the complete loss of fertility which is often observed in spots over sub-soil that is oozy in wet seasons, but which have been kept under tillage, without being drained. We are as yet but little informed as to the particular changes made, and the various new substances successively formed, and then decomposed, during the whole duration of putrescent manures in the soil—and no field for discovery would better reward the investigations of the agricultural chemist. For want of this knowledge we proceed at random in using manures, instead of being enabled to conform to any rule founded on scientific principles; nor can we hope, without such knowledge, so to manage manures with regard to their fermentation, the time and manner of application, mixing with other substances, &c., as to *enable the crops to seize every enriching result as soon as it is produced*, and to *postpone as long as possible the final results of decomposition*—which ought to be the ends sought in every application of putrescent manure.

the surface to the enriching matters furnished by the growth and decay of plants. And therefore, before being brought into cultivation, a poor clay soil would derive scarcely any benefit from its small power of combining chemically with putrescent matters. If then it is considered how small is the power of both silicious and aluminous earths to receive and retain putrescent manures, it will cease to cause surprise that such soils cannot be thus enriched, with profit, if at all. It would indeed be strange and unaccountable, if earths and soils thus constituted *could be* enriched by putrescent manures alone.

Davy states that both aluminous and calcareous earth will combine with any vegetable extract, so as to render it less soluble, (and consequently not subject to the waste that would otherwise take place,) and hence "that the soils which contain most alumina and carbonate of lime, are those which act with the greatest chemical energy in preserving manures." Here is high authority for calcareous earth possessing the power which my argument demands, but not in so great a degree as I think it deserves. Davy apparently places both earths in this respect on the same footing, and allows to aluminous soils retentive powers equal to the calcareous. But though he gives evidence (from chemical experiments) of this power in both earths, he does not seem to have investigated the difference of their forces. Nor could he deem it very important, holding the opinion which he elsewhere expresses, that calcareous earth acts "merely by forming a useful earthy ingredient in the soil," and consequently attributing to it no remarkable chemical effects as a manure. I shall offer some reasons for believing that the powers of attracting and retaining manure, possessed by these two earths, differ greatly in their degrees of force.

Our aluminous and calcareous soils, through the whole of their virgin state, have had equal means of receiving vegetable matter; and if their powers for retaining it were nearly equal, so would be their acquired fertility. Instead of this, while the calcareous soils have been raised to the highest condition, many of the tracts of clay soil remain the poorest and most worthless. It is true that the one labored under acidity, from which the other was free. But if we suppose nine-tenths of the vegetable matter to have been rendered useless by that poisonous quality, the remaining tenth, applied for so long a time, would have made fertile any soil that had the power to retain the enriching matter.

Many kinds of shells are partly composed of gelatinous animal matter, which, I suppose, must be chemically combined with the calcareous earth, and by that means only is preserved from the putrefaction and waste that would otherwise certainly and speedily take place. Indeed, the large proportion of animal matter which thus helps to constitute shells, instead of making them more perishable, serves to increase their firmness and solidity. When long exposure, as in fossil shells, has destroyed all animal matter, the texture of the calcareous substance is greatly weakened. A simple experiment will serve to separate, and make manifest to the eye, the animal matter which is thus combined with and preserved by the calcareous earth. If a fresh-water muscle-shell is kept for some days immersed in a weak mixture of muriatic acid and water, all the calcareous part will be gradually dissolved, leaving the animal matter so entire, as to appear still to be a whole shell—but which, when lifted from the fluid which supports it, will prove to be entirely a flaccid, gelatinous, and putrescent substance, without a particle of calcareous matter being left. Yet this substance, which is so highly putrescent when alone, would have been preserved in combination with calcareous matter, in the shell, for many years, if exposed to the usual changes of air and moisture; and if secured from such changes, would be almost imperishable.

Calcareous earth has power to preserve those animal matters which are most liable to waste, and which give to the sense of smell full evidence when they are escaping. Of this, a striking example is furnished by an experiment which was made with care and attention. The carcass of a cow, that was killed by accident in May, was laid on the surface of the earth, and covered with about seventy bushels of finely divided fossil shells and earth, (mostly silicious,) their proportions being as thirty-six of calcareous, to sixty-four of silicious earth. After the rains had settled the heap, it was only six inches thick over the highest part of the carcass. The process of putrefaction was so slow, that several weeks passed before it was over; nor was it ever so violent as to throw off any effluvia that the calcareous earth did not intercept in its escape, so that no offensive smell was ever perceived. In October, the whole heap was carried out and applied to one-sixth of an acre of wheat—and the effect produced far exceeded that of the calcareous manure alone, which was applied at the same rate on the surrounding land. No such power as this experiment indicated (and which I have since repeated in various modes, and always with like results) will be obtained, or expected from clay.

Quick-lime is used to prevent the escape of offensive effluvia from animal matter; but its operation is entirely different from that of calcareous earth. The former effects its object by "eating" or decomposing the animal substance, (and nearly destroying it as manure,) before putrefaction begins. The operation of calcareous earth is to moderate and retard, but not to prevent putrefaction; not to destroy the animal matter, but to preserve it effectually, by forming new combinations with the products of putrefaction. This important operation will be treated of more fully in a subsequent chapter.

The power of calcareous earth to combine with and retain putrescent manure, implies the power of fixing them in any soil to which both are applied. The same power will be equally exerted if the putrescent manure is applied to a soil which had previously been made calcareous, whether by nature, or by art. When a chemical combination is formed between the two kinds of manure, the one is necessarily as much fixed in the soil as the other. Neither air, sun or rain, can then waste the putrescent manure, because neither can take it from the calcareous earth, with which it is chemically combined. Nothing can effect the separation of the parts of this compound manure, except the attractive power of growing plants—which, as all experience shows, will draw their food from this combination as fast as they require it, and as easily as from sand. The means then by which calcareous earth acts as an improving manure are, *completely preserving putrescent manures from waste, and yielding them freely for use.* These particular benefits, however great they may be, cannot be seen very quickly after a soil is made calcareous, but will increase with time, and, with the means for obtaining vegetable matters, until their accumulation is equal to the soil's power of retention. The kind, or the source, of enriching manure, does not alter the process described. The natural growth of the soil, left to die and rot, or other putrescent manures collected and applied, would alike be seized by the calcareous earth, and fixed in the soil.

This, the most important and valuable operation of calcareous earth, then gives nothing to the soil; but only secures other manures, and gives *them* wholly to the soil. In this respect, the action of calcareous earth in fixing manures in soils, is precisely like that of *mordants* in "setting" or fixing colors on cloth. When alum, for example, is used by the dyer for this purpose, it adds not the slightest tinge of itself—but it holds to the cloth, and also to the otherwise fleeting dye, and thus fixes them per-

manently together. Without the mordant, the color might have been equally vivid, but would be lost by the first wetting of the cloth.

Thus, reasoning *a priori*, from that chemical power possessed by calcareous earth which is wanting to both sandy and clayey earths, would lead to the conclusion that calcareous earth serves to combine putrescent matters with the soil in general; and the known results of fertility being therein so fixed, might serve for the like proof, even without the other course of reasoning. There is still another proof of this combination being formed, which is obtained by a chemical process, but which is so simple that no chemical science is requisite to make the trial.

If a specimen of any naturally poor soil, after being dried and reduced to powder, be agitated in a vessel of water, (as a common drinking glass,) and then allowed to stand still, the coarser silicious sand will subside first, the finer sand next, and last the clay. In this manner, and by pouring off the lighter parts, before their subsidence, it is very easy to separate with sufficient accuracy the sand from the clay. But if a specimen of a good rich *neutral soil* be tried in that manner, it will be found that the fine sand and the clay and putrescent matter hold together so closely that they cannot be separated by mere agitation in water. Then take another sample of the same soil, and pour to it a small quantity of diluted muriatic acid; and though no effervescence is produced, (the lime not being in the form of carbonate,) the acid will take away the lime, or destroy its combination with the other earths, so that the sand and the clay may then be separated by agitation in water, as perfectly and easily as in the case of the poorest soils. This difference between good and bad soils, (whether light or stiff,) or those naturally rich and those naturally poor, cannot escape the observation of the young experimenter; and the cause can be no other than what I have supposed. This then serves as the third mode of proof of the important position, that calcareous earth (or lime in some other form) not only combines with vegetable and animal matters, but also serves (as a connecting link) to combine these matters with the sand and clay of the soil.

The next most valuable property of calcareous manures for the improvement of soil is their *power of neutralizing acids*, which has already been incidentally brought forward in the preceding chapter. According to the views already presented, our poorest cultivated soils contain more vegetable matter than they can beneficially use; and when first cleared, they have it in great excess. So antiseptic is the acid quality of poor wood-land, that before the crop of leaves of one year can entirely rot, two or three others will have fallen; and there are always enough, at any one time, to greatly enrich the soil, if the leaves could be rotted and fixed in it at once.

This alleged antiseptic effect of vegetable acid in our soils receives strong support from the facts established with regard to *peat soils*, in which vegetable acids have been discovered by chemical analysis; and though the peat or moss soils of Britain differ entirely from any soils in eastern Virginia, (except that of the great Dismal Swamp, almost the only peat bog known,) still some facts relating to the former class may throw light on the properties of our own soils, different as they may be. Not only does vegetable matter remain without putrefaction in peat soils and bogs, and serve to increase their depth by regular accretions from the successive annual growths, but even the bodies of beasts and men have been found unchanged under peat, many years after they had been covered. It is well known that the leaves of trees rot very quickly on the rich lime-stone soils of the western

* See Aiton's Essay on Moss Earth, republished in Farmers' Register, vol v., p. 462.

states, while the successive crops of several years' growth, in the different stages of their slow decomposition, may be always found on the acid woodland of lower Virginia.

The presence of acid in soils, by preventing or retarding putrefaction, keeps the vegetable matter inert, and even hurtful on cultivated land; and the crops are still further injured by taking up this poisonous acid with their nutriment. A sufficient quantity of calcareous earth, mixed with such a soil, will immediately neutralize the acid, and destroy its powers; and the soil, released from its baneful influence, will be rendered capable, for the first time, of using the fertility which it really possessed. The benefit thus produced is almost immediate; but though the soil will show a new vigor in its earliest vegetation, and may even double its first crop, yet no part of that increased product is due to the direct operation of the calcareous manure, but merely to the removal of acidity. The calcareous earth, in such a case, has not made the soil richer in the slightest degree, but has merely permitted it to bring into use the fertility it had before, and which was concealed by the acid character of the soil. It will be a dangerous error for the farmer to suppose that calcareous earth can enrich soil by direct means. It destroys the worst foe of productiveness, and uses to the greatest advantage the fertilizing powers of other manures; but of itself it gives no fertility to soils, nor does it furnish the least food to growing plants.*

These two kinds of action are by far the most powerful of the means possessed by calcareous earth for fertilizing soils. It has another however of great importance—or rather two others, which may be best described together as the *power of altering the texture and absorbency* of soils.

At first it may seem impossible that the same manure can produce such opposite effects on soils as to lessen the faults of being either too sandy or too clayey—and the evils occasioned by both the want and the excess of moisture. Contradictory as this may appear, it is strictly true as to calcareous earth. In common with clay, calcareous earth possesses the power of making sandy soils more close and firm—and in common with sand, the power of making clay soils lighter. When sand and clay thus alter the textures of soils, their operation is altogether mechanical; but calcareous earth must have some chemical action also in producing such effects, as its power is far greater than that of either sand or clay. A very great quantity of clay would be required to stiffen a sandy soil perceptibly, and still more sand would be necessary to make a clay soil much lighter—so that the cost of such improvement would generally exceed the

* Perhaps it may be considered that there are exceptions to the above doctrine in the well established facts that certain plants will not grow well, if at all, in soils containing so little lime as to be classed as acid soils, no matter how rich they may be made for the time by putrescent manures. Among trees, locust, papaw, and hackberry have been already named as plants of this kind; and red clover is as remarkable among grasses for requiring lime in the soil. Sainfoin is still more remarkable, and cannot be produced to profit, even if it will live, except on a highly calcareous soil. Lime then is certainly a *specific manure* for these plants; that is, lime promotes their growth in a remarkable and peculiar degree, and they can scarcely live without a considerable quantity in the soil. Still it may be doubted whether it is that they require the lime *as food*, or for some other unknown purpose, no less indispensable. Except as to sainfoin, (of which I have no practical experience,) a moderate proportion of lime in a soil, such as will merely make it neutral, seems to add as much vigor to the growth of the plants named, as if it be given in ten-fold quantity. This would seem to contradict the supposition of the lime serving as food, though it may be as indispensable to these plants as is their food. It is certain that dung, or other rotten vegetable matter, acts as food to all crops which it benefits; and therefore it is, that, in every case of its use and benefit, a large quantity will always produce effects perceptibly better than a small quantity.

benefit obtained. Much greater effects on the texture of soils are derived from much less quantities of calcareous earth, besides obtaining the more valuable operation of its other powers.

Every substance that is open enough for air to enter, and the particles of which are not absolutely impenetrable, must absorb moisture from the atmosphere. Aluminous earth, reduced to an impalpable powder, has strong absorbing powers. But this is not the form in which such soils can act—and a close and solid clay will scarcely admit the passage of air or water, and therefore cannot absorb much moisture except by its surface. Through sandy soils, the air passes freely; but most of its particles are impenetrable by moisture, and therefore these soils are also extremely deficient in absorbent power. Calcareous earth, by rendering clay more open to the entrance of air, and closing partially the too open pores of sandy soils, increases the absorbent powers of both. To increase that power in any soil, is to enable it to draw supplies of moisture from the air, in the driest weather, and to resist more strongly the waste by evaporation of light rains. A calcareous soil will so quickly absorb a hasty shower of rain as to appear to have received less than adjoining land of different character; and yet if observed in summer, when under tillage, some days after a rain, and when other adjacent land appears dry on the surface, the part made calcareous will still show the moisture to be yet remaining, by its darker color. All the effects from this power of calcareous manures may be observed within a few years after their application—though none of them so strongly marked, as they are on lands made calcareous by nature, and in which time has aided and perfected the operation. These soils present great variety in their proportions of sand and clay; yet the most clayey is friable enough, and the most sandy firm and close enough, to be considered soils of good texture; and they resist the extremes of both wet and dry seasons, better than any other soils whatever. Time, and the increase of vegetable matter, will bring those qualities to the same perfection in soils made calcareous by artificial means, as they are in soils made calcareous by nature.

The subsequent gradual accumulation of vegetable or other putrescent matter in the soil, by the combining or fixing power of calcareous earth, must have yet another beneficial effect on vegetation. The soil is thereby made darker in color, and it consequently is made warmer, by more freely absorbing the rays of the sun.

Additional and practical proofs of all the powers of calcareous earth will be furnished, when its use and effects as manure will be stated. I am persuaded, however, that enough has already been said both to establish and account for the different capacities of soils for improvement by putrescent manures. If the power of fixing manures in soils has been correctly ascribed to calcareous earth, that alone is enough to show that soils containing that ingredient, in sufficient quantity, must become rich; and that aluminous and silicious earths mixed in any proportions, and even with vegetable or other putrescent matter added, can never form other than a sterile soil.

CHAPTER IX.

ACTION OF CAUSTIC LIME AS MANURE. CLASSIFICATION OF MANURES.

The object of this essay is to treat only of calcareous earth (as before defined) as a manure, and not of pure lime, nor of manures in general. Still the nature of that which is properly my subject is so intimately connected with some other kinds of manures, and is so liable to be confounded with others which act very differently, that frequent references to both classes have been and will be again necessary. To make such references more plain and useful, some general remarks and opinions will now be submitted, as to the peculiar modes of the operation of various manures, and particularly of lime.

Until now I have been careful to say as little as possible of *pure* or *quick lime*, for fear of my meaning being mistaken, from the usual practice of confounding it with calcareous earth; or of considering both its first and later operations as belonging to one and the same manure. The connexion between the manures is so intimate, and yet their actions so distinct, that it is necessary to mark the points of resemblance as well as those of difference.

My own use of quick or caustic lime as a manure has not extended beyond a few acres; and I do not pretend to know any thing from experience of its first or caustic effects. But Davy's simple and beautiful theory of its operation carries conviction with it, and in accordance with his opinions I shall state the theory, and thence attempt to deduce its proper practical use.

By a sufficient degree of heat, the carbonic acid is driven off from shells, lime-stone, or chalk, and the remainder is pure or caustic lime. In this state it has a powerful decomposing power on all putrescent animal and vegetable matters, which it exerts on every such substance in the soils to which it is applied as manure. If the lime thus meets with solid and inert vegetable matters, it hastens their decomposition, renders them soluble, and brings them into use and action as manure. But such vegetable and animal matters as were already decomposed, and fit to support growing plants, are injured by the addition of lime; as the chemical action which takes place between these bodies forms different compounds, which are always less valuable than the putrid or soluble matters were, before being acted on by the lime.*

This theory will direct us to expect profit from applying caustic lime to all soils containing much unrotted and inert vegetable matter, as our acid wood-land when first cleared, and perhaps worn fields, covered with broom-grass; and to avoid the application of lime, or (what is the same thing) to destroy previously its caustic quality by exposure to the air, for all good soils containing soluble vegetable or animal matters, and on all poor soils deficient in inert, as well as in active nourishment for plants. The warmth of our climate so much aids the fermentation of all putrescent matters in soils, that it can seldom be required to hasten it by artificial means. To check its rapidity is much more necessary, to avoid the waste of manures in our lands. But in England, and still more in Scotland, the case is very different. There, the coldness and moisture of the climate greatly retard the fermentation of the vegetable matter that falls on the land; so much so that, in certain situations, the most favorable to such results, the vegetable cover is

* Davy's Agr. Chem. Lect. vii.

increased by the deposite of every successive year, and forms those vegetable soils which are called *moor*, *peat*, and *bog* lands. Vegetable matter abounds in these soils, and sometimes it even forms the greater bulk for many feet in depth; but it is inert, insoluble, and useless, and the soil is unable to bring any useful crop, though containing vegetable matter in such great excess. Many millions of acres in Britain are of the different grades of peat soils, of which almost none exist in the eastern half of Virginia. Upon this ground of the difference of climate, and its effects on fermentation, I deduce the opinion that *caustic lime* would be serviceable much more generally in Britain than here; and indeed that there are very few cases in which the caustic quality would not do our arable lands more harm than good. This is no contradiction to the great improvements which have been made on many farms by applying lime; for its caustic quality was seldom allowed to act at all. Lime is continually changing to the carbonate of lime; and, in practice, no exact line of separation can be drawn between the transient effects of the one, and the later, but durable improvement from the other. Lime powerfully attracts the carbonic acid of which it was deprived by heat, and that acid is universally diffused through the atmosphere (though in a very small proportion,) and is produced by every decomposing putrescent substance. Consequently, caustic lime, when on land, is continually absorbing and combining with this acid; and, with more or less rapidity, according to the manner of its application, is returning to its former state of mild calcareous earth. If spread as a top-dressing on grass lands—or on ploughed land, and superficially mixed with the soil by harrowing—or used in composts with fermenting vegetable matter—the lime is probably completely carbonated, before its causticity can act on the soil. In no case can lime, applied properly as manure, long remain caustic in the soil. Thus most applications of *lime* are, in effect, simply applications of *calcareous earth* but acting with greater energy and power at first, in proportion to its quantity, because more finely divided, and more equally distributed.

Some account of the mode of using burnt lime in lower Virginia by many farmers who cannot as well avail themselves of cheaper means to render their lands calcareous, and the effects produced, will be given in a subsequent part of this essay.

By adopting the views which have been presented of the action of calcareous earth, and of lime, as manures, and those which are generally received as to the modes of operation of other manures, the following table has been constructed, which may be found useful, though necessarily imperfect, and in part founded only on conjecture. The various particular kinds of manures are arranged in the supposed order of their power, under the several heads or characters to which they belong; and when one manure possesses several different modes of action, the comparative force of each is represented by the letters annexed—the letter *a* designating its strongest or most valuable agency, *b* the next strongest, and so on as to *c* and *d*.

PROPOSED CLASSIFICATION OF MANURES.

Substances which act as manures are either

- *Alimentary*, or serving as food for plants— as
  - Feathers, hair, woollen rags,
  - Pounded bones, (*b*)
  - All putrescent animal and vegetable substances, as dung,
  - Stable and farm-yard manures, (*a*)
  - Straw, (*a*)
  - Green crops ploughed in, and dead grass and weeds left on the surface. (*a*)
- *Solvent* of alimentary manures— as
  - Quick-lime, (*a*)
  - Potash and soap lie? (*a*)
  - Wood ashes not drawn? (*d*)
  - Paring and burning the surface of the soil. (*a*)
- *Fixers, or Mordants*— serving to combine with or *set* other manures in soils — as
  - Calcareous earth, including
  - Lime become mild by exposure, (*a*)
  - Chalk, (*a*)
  - Lime-stone gravel, (*a*)
  - Wood ashes, (*b*)
  - Fossil shells, (or shell marl,) (*a*)
  - Marl (a calcareous clay,) (*a*)
  - Old mortar and lime cements.
- *Neutralizing* acids— as
  - All calcareous manures, (*b*)
  - Quick-lime, (*b*)
  - Potash and soap lie, (*b*)
  - Wood ashes. (*c*)
- *Mechanical*, or improving by altering the texture of soil— as
  - All calcareous manures, (*c*)
  - Marl, (*b*)
  - Clay,
  - Sand,
  - Fermenting vegetable manures, (*b*)
  - Green manures, (*b*)
  - Unfermented litter. (*b*)
- *Stimulating*—as
  - Nitre?
  - Common salt? (*b*)
- *Specific*, or furnishing ingredients necessary for particular plants— as
  - Sulphate of lime, or gypsum, (for clover,)
  - Gypseous earth, (or green-sand earth,) for clover.
  - Calcareous manures (for clover)
  - Phosphate of lime, (for wheat) in
  - Bones, (*a*) and
  - Drawn ashes, (*a*)
  - Salt, for asparagus. (*a*)

AN

ESSAY

ON

CALCAREOUS MANURES.

PART SECOND—PRACTICE.

CHAPTER I.

INTRODUCTORY AND GENERAL OBSERVATIONS ON MARL AND LIME. REMARKS ON THE EXPERIMENTS TO FOLLOW.

PROPOSITION 5. *Calcareous manures will give to our worst soils a power of retaining putrescent manures, equal to that of the best—and will cause more productiveness, and yield more profit, than any other improvement practicable in lower Virginia.*

THE theory of the constitution of fertile and barren soils, has now been regularly discussed. It remains to show its practical application, in the use of calcareous earth as a manure. If the opinions which have been maintained are unsound, the attempt to reduce them to practice will surely expose their futility; and if they pass through that trial, agreeing with and confirmed by facts, their truth and value must stand on impregnable ground. The belief in the most important of these opinions, (the incapacity of poor soils for improvement, and its cause,) first directed the commencement of my use of calcareous manures; and the manner of my practice has also been directed entirely by the views which have been exhibited. Yet in every respect the results of practice have sustained the theory of the action of calcareous manures; unless indeed there be claimed as exceptions the injuries which have been caused by applying too heavy dressings to weak lands; and also the beneficial effects of proper practice being found to exceed in degree what the theory seemed to promise.

My use of calcareous earth as manure has been almost entirely confined to that form of it which is so abundant in the neighborhood of our tide-waters—the beds of *fossil shells*, together with the earth with which they are found mixed. The shells are in various states—in some beds generally whole, and in others reduced nearly to a coarse powder. The earth which fills their vacancies, and serves to make the whole a compact mass, in most cases is principally silicious sand, and contains no putrescent or valuable matter, other than the calcareous.* The same effects might be expected from calcareous earth in any other form, whether chalk, lime-stone gravel,

* From later observation I have formed the opinion that the coloring matter of blue marls is vegetable extract, chemically combined with the calcareous matter, of which opinion the grounds will be stated hereafter. But still the amount of this vegetable admixture is too small to have much appreciable effect as food for plants; and, practically, the general position assumed above may yet be considered as altogether true.

wood ashes, or lime—though the two last have other qualities besides the calcareous. During the short time that lime can remain *quick* or *caustic*, after being applied as manure, it exerts (as before stated) a solvent power, sometimes beneficial and at others hurtful, which has no connexion with its subsequent and permanent action as calcareous earth.

These natural deposites of fossil shells are commonly, but very improperly, called *marl*. This misapplied term is particularly objectionable, because it induces erroneous views of this manure. Other earthy manures have long been used in England under the name of marl, and numerous publications have described their general effects, and recommended their use. When the same name is given here to a different manure, many persons will consider both operations as similar, and perhaps may refer to English authorities for the purpose of testing the truth of my opinions, and the results of my practice. But no two operations called by the same name can well differ more. The process which it is my object to recommend, is simply *the application of calcareous earth in any form whatever, to soils wanting that ingredient*, and generally being quite destitute of it; and the propriety of the application depends entirely on the knowing that the manure contains calcareous earth, and what proportion, and that the soil contains none. In England, the most scientific agriculturists apply the term *marl* correctly to a *calcareous clay* of peculiar texture; but most authors, as well as mere cultivators, have used it for any smooth soapy clay, which may or may not have contained, so far as they knew, any proportion whatever of calcareous matter. Indeed, in most cases, they seem unconscious of the presence as well as of the importance of that ingredient, by their not alluding to it when attempting most carefully to point out the characters by which marl may be known. Still less do they inquire into the deficiency of calcareous earth in soils proposed to be marled—but apply any earth which either science or ignorance may have called *marl*, to any soils within a convenient distance—and rely upon the subsequent effects to direct whether the operation shall be continued or abandoned. Authors of the highest character, (as Sinclair and Young, for example,) when telling of the practical use and valuable effects of marl, omit giving the strength of the manure, and generally even its nature—and in no instance have I found the ingredients of the soil stated, so that the reader might learn what kind of operation really was described, or be enabled to form a judgment of its propriety. From all this, it follows that though what is called *marling* in England may sometimes (though very rarely, as I infer,) be the same chemical operation on the soil that I am recommending, yet it may also be either applying clay to sand, or clay to chalk, or true marl to either of those soils; and the reader will generally be left to guess, in every separate case, which of all these operations is meant by the term *marling*. For these reasons, the practical knowledge to be gathered from all this mass of written instruction on marling will be far less abundant than the inevitable errors and mistakes. The recommendations of marl by English authors, induced me very early to look to what was here called by the same name, as a means for improvement. But their descriptions of the manure convinced me that our marl was nothing like theirs, and thus actually deterred me from using it, until other and more correct views instructed me that its value did not depend on its having "a soapy feel," or on any admixture of clay whatever.

Nevertheless, much valuable information may be obtained from these same works, on calcareous manure, or on marl, (in the sense that term is used among us)—but under a different head, viz., *lime*. This manure is generally treated of with as little clearness or correctness, as is done with marl;

but the reader at least cannot be mistaken in this, that the ultimate effect of every application of lime must be to make the soil more calcareous; and to that cause solely are to be imputed all the long-continued beneficial consequences, and great profits, which have been derived from liming. But excepting this one point, in which we cannot be misled by ignorance or want of precision, the mass of writings on lime, as well as on calcareous manures in general, will need much sifting to yield instruction. The opinions published on the operation of lime are so many, so various, and so contradictory, that it seems as if each author had hazarded a guess, and added it to a compilation of those of all who had preceded him. For a reader of these publications to be able to reject all that is erroneous in reasoning, and in statements of facts— or inapplicable, on account of difference of soil, or other circumstances—and thus obtain only what is true, and useful—it would be necessary for him first to understand the subject better than most of those whose opinions he was studying. Indeed it was not possible for them to be correct, when treating (as most do) of *lime* as one kind of manure, and every different form of the *carbonate of lime* as so many others. Only one distinction of this kind (as to operation and effects) should be made, and never lost sight of—and that is one of substance, still more than of name. Pure or quick-lime, and carbonate of lime are manures entirely different in their powers and effects. But it should be remembered that the substance that was *pure lime* when just burned, often becomes *carbonate of lime* before it is used, (by absorbing carbonic acid from the atmosphere,)—still more frequently before a crop is planted—and probably always before the first crop ripens. Thus, it should be borne in mind that the manure spoken of as lime is often at first, and always at a later period, neither more nor less than calcareous earth; that lime, which at different periods is two distinct kinds of manure, is considered in agricultural treatises as only one; and to calcareous earth are given as many different names, all considered to have different values and effects, as there are different forms and mixtures of the substance presented by nature.

But, however incorrect and inconvenient the term *marl* may be, custom has too strongly fixed its application for any proposed change to be adopted. Therefore, I must submit to use the word *marl* to mean beds of *fossil shells*, notwithstanding my protest against the propriety of its being so applied.

The following experiments are reported, either on account of having been accurately made and carefully observed, or as presenting such results as have been generally obtained on similar soils, from applications of fossil shells to nearly six hundred acres of Coggins Point farm (made before 1830.) It had been my habit to make written memoranda of such things; and the material circumstances of these experiments were put in writing at the time they occurred, or not long after. Some of the experiments were, from their commencement, designed to be permanent, and their results to be measured as long as circumstances might permit. These were made with the utmost care. But generally, when precise amounts are not stated, the experiments were less carefully made, and their results reported by guess. Every measurement stated, of land or of crop, was made in my presence. The average strength of the different marls used was ascertained by a sufficient number of analyses; and the quantity applied was known by measuring some of the loads, and having them dropped at regular distances. At the risk of being tedious, I shall state every circumstance supposed to affect the results of the experiments; and the manner of description, and of reference, necessary to use, will require a degree of attention that few readers may be disposed to give, to enable them to derive the full

benefit of these details. But, however disagreeable it may be to give to them the necessary attention, I will presume to say that these experiments deserve it. They will present practical proofs of what otherwise would be but uncertain theory—and give to this essay its principal claim to be considered truly instructive and useful.

When these operations were commenced, I knew of no other experiments having been made with fossil shells, except two, which had been tried long before, and were considered as proving the manure to be too worthless to be resorted to again.

The earliest of these old experiments was made at Spring Garden, in Surry, about 1775, by Mr. Wm. Short, proprietor of that estate. The extent marled was eight or ten acres, on poor sandy land. Nothing is now known of the effects for the first twenty-five or thirty years, except that they were too inconsiderable to induce a repetition of the experiment. The system of cultivation was doubtless as exhausting as usual at that time. Since 1812, the farm has been under mild and improving management generally. No care has been taken to observe the progress either of improvement or exhaustion on the marled piece; but there is no doubt that the product has continued for the last fifteen years better than that of the adjacent land. Mr. Francis Ruffin, the present owner of the farm, believed that the product was not much increased in favorable seasons; but when the other land suffered, either from too much wet, or dry weather, the crop on the marled land was comparatively but slightly injured. The loose reports that have been obtained respecting this experiment are at least conclusive in showing the long duration of the effects produced.

The other old experiment referred to was made at Aberdeen, Prince George county, in 1803, by Mr. Thomas Cocke. Three small spots (neither exceeding thirty yards square,) of poor land, kept before and since generally under exhausting culture, were covered with this manure. He found a very inconsiderable early improvement, which he thought altogether an inadequate reward for the labor of applying the marl. The experiment, being deemed of no value, was but little noticed until after the commencement of my use of the same manure. On examination, the improvement appeared to have increased greatly on two of the pieces, but the third was evidently the worse for the application. For a number of years after making this experiment, Mr. Cocke considered it as giving full proof of the worthlessness of the manure. But more correct views of its mode of operation, induced by my experiments and reasoning, induced him to recommence its use; and no one has met with more success, or produced more valuable early improvement.

Inexperience, and the total want of any practical guide, caused my applications, for the first few years, to be frequently injudicious, particularly as to the quantities laid on. For this reason, these experiments will show what was actually done, and the effects thence derived, and not what better information would have directed as the most profitable course.

The measurements of corn that will be reported were all made at the time and place of gathering. The measure used for all except very small quantities was a barrel, holding five bushels when filled level, and which being filled twice with ears of corn, well shaken to settle them, and heaped, was estimated to make five bushels of grain; and the products will be reported in *grain*, according to this estimate. This mode of measurement will best serve for comparing results; but in most cases it is far from giving correctly the actual quantity of dry and sound grain, for the following reasons. The common large soft-grained white corn was the kind cultivated, which was always cut down for sowing wheat before the best

matured was dry enough to grind, or even to be stored for keeping; and when the ears from the poorest land were in a state to lose considerably more by shrinking. Yet, for fear of some mistake occurring if measurements were delayed until the crop was gathered, these experiments were measured when the land was ploughed for wheat in October. The subsequent loss from shrinking would of course be greatest on the corn from the poorest and most backward land, as the most defective and unripe ears would always be there found. Besides, every ear, however imperfect or rotten, was included in the measurement. For these several reasons, the actual increase of product on the marled land was always greater than will appear from the comparison of quantities measured; and from the statements of all such early measurements, there ought to be allowed a deduction, varying from 10 or 15 per cent. on the best and most forward corn, to 30 or 35 per cent. on the latest and most defective. Having stated the grounds of this estimate, practical men can draw such conclusions as their experience may direct, from the dates and amounts of the actual measurements that will be reported. Some careful trials of the amount of shrinkage in particular experiments will be hereafter stated.

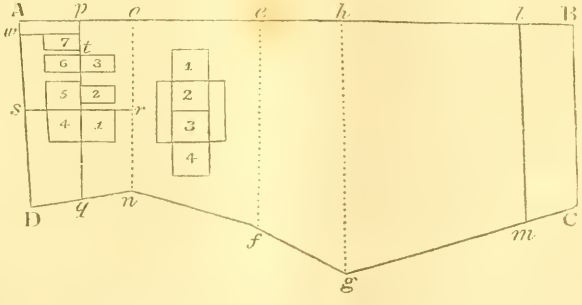
No grazing had been permitted on any land from which experiments will be reported, since 1814, (or since being cleared, if in forest at that time,) unless the contrary shall be specially stated. The cropping had also been mild, during that time, though previously it was the usual exhausting three-shift and grazing course.

CHAPTER II.

EFFECTS OF CALCAREOUS MANURES ON ACID SANDY SOILS, NEWLY CLEARED.

Proposition 5—continued.

As most of the experiments on new land were made on a single piece of twenty-six acres, a general description or plan of the whole will enable me to be better understood, as well as to be more concise, by references being made to the annexed figure. It forms part of the ridge or high table land lying between James river and the nearest stream running into Powell's creek. The surface is nearly level, but slightly undulating. The soil in its natural state very similar throughout, but the part next to the line B C



somewhat more sandy, and more productive in corn, than the part next to A D; and, in like manner, it is lighter along A *e*, than nearer to D *f*. The whole soil, a gray sandy acid loam, not more than two inches deep at first, resting on a yellowish sandy sub-soil, from one to two feet deep, when it changes to clay. Natural growth mostly pine—next in quantity, oaks of different kinds—a little of dogwood and chinquepin—whortleberry bushes throughout in plenty. The quality of the soil better than the average of ridge lands in general, but yet quite poor. Judging from experience of adjoining grounds and similar soil, this land would have produced as its early and best crop, and under the best treatment, about 12 bushels of corn to the acre, well ripened and fully shrunk. And if thereafter kept under ordinary culture and management, the products would have gradually and speedily sunk to 5 bushels to the acre. Being still less suitable to wheat, that crop would have been scarcely worth being sown on the land in its best natural state, (when the product might be 6 bushels,) and certainly not at all after a few years of the usual downward progress. The effects of putrescent manures were very transient, as on all such poor lands.

Experiment 1.

The part B C *g h*, about eleven acres, grubbed and the trees cut down in the winter of 1814–15—suffered to lie three years with most of the wood and brush on it. February, 1818, my earliest application of marl was made on the smaller part B C *m l*, about 2½ acres. Marl, containing 33 per cent. of pure calcareous earth, and the balance silicious sand, except a very small proportion of clay; the shelly matter finely divided. Quantity of marl to the acre, one hundred and twenty-five to two hundred heaped bushels. The whole space B C *g h* coultered, and planted in its first crop of corn in 1818. This was my earliest experiment of calcareous manures.

Results. 1818. The corn on the marled land evidently much better—supposed difference, forty per cent.

1819. In wheat. The difference as great, perhaps more so—particularly to be remarked from the commencement to the end of the winter, by the marled part preserving a green color, while the remainder was seldom visible from a short distance, and in the spring stood much thinner, from the greater number of plants killed during the winter. The line of separation very perceptible throughout both crops.

1820. At rest. During the summer marled all B C *g h*, at the rate of five hundred bushels, without excepting the space before covered, and a small part of that made as heavy as one thousand bushels, counting both dressings. The shells now generally coarse—average strength of the marl, 37 per cent. of calcareous earth. In the winter after, ploughed three inches deep only, as nearly as could be; which however, shallow as it was, made the whole new surface yellow, by bringing the barren sub-soil of yellow sand to the top. One of my neighbors, an intelligent and experienced farmer, who saw the land when in this state, pronounced that I "had ruined the land for ever, by ploughing and turning the soil too deep."

Results continued, 1821. In corn. The whole a remarkable growth for such a soil. The oldest (and heaviest) marled piece better than the other, but not enough so to show the dividing line. The average product of the whole supposed to have been fully twenty-five bushels of ripe and good corn to the acre.

1822. In wheat—and red clover sowed on all the old marling, and one or two acres adjoining. A severe drought in June killed the greater part

of the clover, but left it much the thickest on the oldest marled piece, so as again to show the dividing line, and to yield, in 1823, two middling crops to the scythe—the first that I had known obtained from any acid soil, without high improvement from putrescent manures.

1823. At rest—nothing taken off, except the clover on B C *m l*.

1824. In corn—product seemed as before, and its rate may be inferred from the actual measurements on other parts, which will be stated in the next experiment, the whole twenty-six acres being now cleared, and brought under like cultivation.

Experiment 2.

The part *e f n o*, cleared and cultivated in corn at the same times as the preceding—but treated differently in some other respects. This had been deprived of nearly all its wood, and the brush burnt, at the time of cutting down—and its first crop of corn (1818) being very inferior, was not followed by wheat in 1819, because promising too little product to pay for the cost of the crop. This gave two years of rest before the crop of 1821—and five years rest out of six, since the piece had been cut down. As before stated, the soil rather lighter on the side next to *o e*, than *n f*.

March, 1821. A measured acre near the middle, covered with six hundred bushels of calcareous sand, containing 20 per cent. of calcareous earth, the upper layer of another body of fossil shells.

Results. 1821. In corn. October—the four adjoining quarter acres, marked 1, 2, 3, 4, extending nearly across the piece, two of them within, and two without the marled part, measured as follows:

Not marled, No. 1, $6\frac{1}{8}$
Do. No. 4, $5\frac{1}{8}$
} average to the acre $22\frac{1}{2}$ bushels of grain.

Marled, No. 2, $8\frac{1}{2}$
Do. No. 3, $8\frac{1}{8}$
} average $33\frac{1}{4}$ bushels.

The remainder of this piece was marled before sowing wheat in 1821.

1823. At rest.

1824. In corn—distance $5\frac{1}{2}$ by $3\frac{1}{4}$ feet, making 2436 stalks to the acre. October 11th, measured two quarter acres very nearly coinciding with Nos. 2 and 3 in the last measurement. The products now were as follows:

No 2 brought 7 bushels $3\frac{1}{4}$ pecks,
or per acre, - - - 31.1
No 3 brought 8 bushels, - - 32
} average $31.2\frac{1}{2}$

Average in 1821, - - - - - 33.1

Experiment 3.

The part *e f g h* was cut down in January, 1821, and the land planted in corn the same year. The coultering and after-tillage very badly executed, on account of the number of whortleberry and other roots. As much as was convenient was marled at six hundred bushels, 37 per cent. and the dressing limited by a straight line. Distance of corn $5\frac{1}{2}$ by $3\frac{1}{2}$ feet—2262 stalks to the acre.

Results. 1821. October—on each side of the dividing line, a piece of twenty-eight by twenty-one corn hills measured as follows:

No. 1, 588 stalks, not marled, 2 bushels, equal to 7 bushels 3 pecks the acre.
No. 2, 588 stalks, marled, $4\frac{1}{4}$ 16 bushels $2\frac{1}{2}$ pecks.

1822. In wheat, the remainder having been previously marled.

1823. At rest. During the following winter it was covered with a second dressing of marl at 250 bushels, 45 per cent., making 850 bushels to the acre altogether.

1824. In corn. Two quarter acres, chosen as nearly as possible on the same spaces that were measured in 1821, produced as follows:

No. 1 made 8 bushels, 2 pecks, or to the acre,	34 bushels.
The same in 1821, before marling,	7.3¼
Increase, - - - - - - -	26.0¾
No. 2 made 7 bushels, 2½ pecks, or to the acre,	30.2
The same in 1821, after marling,	16.2½
Increase average, - - - - - -	13.3½

The second dressing of marl, or the larger quantity, had but little effect in making the increase of crops greater than in 1821. The difference was caused mainly by the greater length of time since the clearing of the land.

1825. The whole twenty-six acres, including the subjects of all these experiments and observations, were in wheat. The first marled piece, in Exp. 1, was decidedly the best—and a gradual decline was to be seen to the latest. I have never measured the product of wheat from any experiment, on account of the great trouble and difficulty that would be encountered. Even if the wheat from small measured spaces could be reaped and secured separately, during the urgent labors of harvest, it would be scarcely possible afterwards to carry the different parcels through all the operations necessary to show exactly the clean grain derived from each. But without any separate measurement, all my observations convince me that the increase of wheat, from marling, was at least equal to that of corn, during the first few years, and certainly greater afterwards, in comparison to the product before using marl.

It was from the heaviest marled part of Exp. 1, that soil was analyzed to find how much calcareous earth remained in 1826, (page 50.) Before that time the marl and soil had been well mixed by ploughing to the depth of five inches. One of the specimens of this soil then examined consisted of the following parts—half an inch of the surface, and consequently the undecomposed weeds upon it, being excluded.

1000 grains of soil yielded

769	grains of silicious sand moderately fine,
15	finer sand,
784	
8	calcareous earth, from the manure applied,
180	finely divided gray clay, vegetable matter, &c.
28	lost in the process.
1000	

This part, it has been already stated, was originally somewhat lighter than the general texture of the remainder of the land.

Experiment 4.

The four acres marked A D *n o* were cleared in the winter of 1823--4. The lines *p q* and *r s* divide the piece nearly into quarters. The end nearest A *p o* is lighter, and best for corn, and was still better for the first crop, owing to nearly all that half having been accidentally burnt over. After twice coultering, marl and putrescent manures were applied as follows; and the products measured, October 11th, the same year.

s q not marled nor manured—produced on a quarter acre, (No. 4,) of soft and badly filled corn,

	Bush.P.
3 bushels, - - - - - - - - - or per acre	12.

q r and *r p*, marled 800 bushels (45 per cent.) by three measurements of different pieces—

Quarter acre (No. 1.) 5 bushels, very nearly, or per acre	19.3½
Eighth (No. 2) 2.3¼ } average }	22.2
Eighth (No. 3) 3.1¼ } 24.1½ }	27.

s t manured at 900 to 1100 bushels to the acre, of which,

Quarter acre (No. 5) with rotted corn stalks, from a winter cow-pen, gave 5.2½ - - - - - - - - - -	22.2
Eighth (No. 6) with stable manure, 4.1¾ - - -	35.2
Eighth (No. 7) covered with the same heavy dressings of stable manure, and of marl also, gave 4.2	36.

p w, marled at 450 bushels, brought not so good a crop as the adjoining *r p* at 800.

The distance was 5½ by 3¼ feet. Two of the quarter acres were measured by a surveyor's chain, (as were four other of the experiments of 1824,) and found to vary so little from the distance counted by corn rows, that the difference was not worth notice.

1825. In wheat, the different marked pieces seemed to yield in comparison to each other, proportions not perceptibly different from those of the preceding crop—but the best not equal to any of the land marled before 1822, as stated in the 1st, 2d and 3d experiments.

1827. Wheat on a very rough and imperfect summer fallow. This was too exhausting a course (being three grain crops in the four shift rotation,) —but was considered necessary to check the growth of bushes that had sprung from the roots still living. The crop was small, as might have been expected from its bad preparation.

1828. Corn—in rows five feet apart, and about three feet of distance along the rows, the seed being dropped by the step. Owing to unfavorable weather, and to insects and other vermin, not more than half of the first planting of this field lived—and so much replanting of course caused its product to be much less matured than usual, on the weaker land. All the part not marled (and more particularly that manured) was so covered by sorrel, as to require ten times as much labor in weeding as the marled parts, which, as in every other such case, bore no sorrel. October 15th, gathered and measured the corn from the several spaces, which were laid off (by the chain) as nearly as could be, on the same land as in 1824. The products so obtained, together with those of the previous and subsequent courses of tillage, will be presented below in a tabular form, for the purpose of being more readily compared.

On the wheat succeeding this crop, clover seed was sown, but very thinly, and irregularly. On the parts not marled, only a few yards width received seed, which the next year showed the expected result of scarcely any living clover, and that very mean. On the marled portions, the growth of clover was of middling quality. Was not mowed nor grazed, but seed gathered by hand both in 1830 and 1831.

1832. Again in corn. It was soon evident that much injury was caused to the marled half *q p o n*, by the too great quantity applied. A considerable proportion of the stalks, during their growth, showed strongly the marks of disease from that cause, and some were rendered entirely barren. A few stalks only had appeared hurt by the quantity of marl in 1828. On the lightly marled piece, *w p*, and also on *w t*, where the heaviest marling

was accompanied by stable manure, there appeared no sign of injury. The products of the three successive crops were as follows:

MARKS.	DESCRIPTION.	PRODUCTS OF GRAIN PER ACRE.		
		1st course. 1824. October 11.	2d course. 1828. October 15	3d course. 1832. October 26
		Bush. pecks	Bush. pks.	Bush. pks.
s q	Not marled or manured,	12	21 1	17 3½
q r 1	Marled at 800 bushels,	19 3½	28 1½	28
r p 2	The same,	22 2	31 0½	27 3
r p 3	The same,	27		
s t 5	Cow-pen manure only, 900 to 1100 bushels,	22 2	25 2	more than *sq*
s t 6	Stable manure only, 900 to 1100 bushels,	35 2	29	28 1
w t 7	Marl and stable manure, both as above,	36	33 2	37 3½
w p	Marled at 450 bushels,	Less than *r p* (800)	Equal to *r p*	31 3

An accidental omission prevented the measurement of *s t* 5, in 1832.

This experiment has been made with much trouble, and every care bestowed to ensure accuracy. Still several causes have operated to affect the correctness of the results, and to prevent the comparative products showing the true rate of improvement, either from the marl or the putrescent manure. These causes will be briefly stated.

1st. The quantity of marl (800 bushels) on *q r* and *r p* is nearly double the amount that ought to have been used; and this error has not only increased the expense uselessly, but has served to prevent the increase of product that would otherwise have taken place. This loss is proved by the gradual increase, and at last the greater product of *w p*, marled at only 450 bushels.

2d, The comparative superiority of all the marled ground to *s q*, not marled, is lessened by this circumstance: most of the large logs, as well as all the small branches, were burnt upon the land, when it was cleared in 1824, before the experiment was commenced; and the ashes have durably improved a spot where each of these large fires was made on *s q*, but have done no good, and perhaps have been injurious, to the marled pieces that were made sufficiently calcareous without the addition of ashes. At least, the good effect of ashes, on spots, is very evident in *s q*, and has helped somewhat to increase all its measured products, and no such benefit has been visible on the marled parts.

3rd. The quantity of putrescent manure applied to *s t* (900 to 1100 bushels) was much too great both for fair experiment and profit; and the excess of quantity, together with the imperfectly rotted state of the stable manure, has given more durability to the effect, than is to be expected from a more judicious and economical rate of manuring on such land when not marled. For these several reasons, it is evident that far more satisfactory results than even these would have been obtained, if only half as much of either marl or manure had been applied.

There are other circumstances to be considered, which, if not attended to, will cause the comparative increase or decrease of product in this experiment to be misunderstood. It is well known that poor land put under tillage immediately after being cleared, as this was in 1824, will not yield near as much as on the next succeeding course of crops. This increase,

which depends merely on the effects of time, operates independently of all other means for improvement that the land may possess; and its rate, in this experiment, may be fairly estimated by the increase on the piece *s q* from 1824 to 1828. The increase here, where time only acted, was from 12 to 21¼ bushels. But as the corn gathered here was always much the most imperfectly ripened, and would therefore lose the most by shrinking, I will suppose eight bushels to be the rate of increase from time, and that so much of the product of all the pieces should be attributed to that cause. Then to estimate alone the increased or diminished effects of marl, or manure on the other pieces, eight bushels should be deducted from all the different applications, and the estimate will stand thus:

	1824.		1828.	Deduct for time.	Increase.	Decrease	
	B. P.		B. P.	B.	B.P.	B. P.	
q r 1	19 3⅓		28 1½	8	0 2	——	From 800 bushels of marl.
r p 2	22 2	24 1½	31	8	——	1 1½	800 bushels of marl.
r p 3	27						
s t 5	22 2		25	8	——	5 2	1000 bush. cow-pen manure
s t 6	35 2		29	8	——	14 2	1000 bush. stable manure.

Even the piece covered with both marl and stable manure (*w t*) shows according to this estimate a diminished effect equal to 10½ bushels; which was owing to the marl not being able to combine with, and fix, so great a quantity of manure, in addition to the vegetable matter left by its natural growth of wood. The piece *w p*, marled at 450 bushels alone, has shown a steady increase of product at each return of tillage, and thereby has given evidence of its being the only improvement made in such manner as both judgment and economy would have directed.

After the crop and measurement of 1832, it was inferred that the separate products of such small spaces could no longer be relied on, owing to the mixture of the surfaces of adjacent parts, necessarily caused by tillage. Therefore the previously omitted parts were marled before the next course of crops came round.

CHAPTER III.

EFFECTS OF CALCAREOUS MANURE ON ACID CLAY SOILS, RECENTLY CLEARED.

The two next experiments were made on another field of thirty acres of very uniform quality, marled and cleared in 1826 and the succeeding years. The soil is very stiff, close, and intractable under cultivation—seems to contain scarcely any sand—but, in fact, about one-half of it is composed of silicious sand, which is so fine, when separated, as to feel like the finest flour. Only a small proportion of the sand is coarser than this state of impalpable powder. Aluminous earth of a dirty fawn color forms nearly all of its remaining ingredients. Before being cleared of the forest growth, and ploughed, the soil is not an inch deep; and all below, for many feet, is apparently composed of the like parts of clay and fine sand. This is decidedly the most worthless kind of soil, in its natural state, that our district furnishes. It is better for wheat than for corn, though its product is contemptible in every thing. It is difficult to be made wet, or dry—and therefore suffers more than other soils from both dry and wet seasons, but

especially from the former. It is almost always either too wet or too dry for ploughing; and sometimes it will pass through both states in two or three clear and warm days. If broken up early in winter, the soil, instead of being pulverized by frost, like most clay lands, runs together again by freezing and thawing; and by March, will have a sleek (though not a very even) crust upon the surface, quite too hard to plant on without a second ploughing. The natural growth is principally white and red oaks, a smaller proportion of pine, and an under-growth of whortleberry bushes throughout.

Experiment 5.

On one side of this field a marked spot of thirty-five yards square was left out, when the adjoining land was marled at the rate of five hundred to six hundred bushels, (37 per cent.,) to the acre. Paths for the carts were opened through the trees, and the marl dropped and spread in January, 1826, and the land cleared the following winter. Most of the wood was carried off for fuel; the remaining logs and brush burnt on the ground, as usual, at such irregular distances as were convenient to the laborers. This part was perhaps the poorer, because wood had previously been cut here for fuel; though only a few trees had been taken, here and there, each winter, for a long time past.

Results, 1827. Planted in corn the whole recent clearing of fifteen acres —all marled, except the spot left out for experiment: broken up late and badly, and worse tilled, as the land was generally too hard, until the season was too far advanced to save the crop. The whole product so small, that it was useless to attempt to measure the products. The difference would have been only between a few imperfect ears on the marled ground, and still less—indeed almost nothing—on that not marled.

1828. Again in corn—as well broken and cultivated as usual for such land. October 8th—cut down four rows of corn running through the land not marled, and eight others, alongside on the marled—all fifty feet in length. The rows had been laid off for five and a half feet—but were found to vary a few inches—for which the proper allowance was made, by calculation. The spaces taken for measurement were caused to be thus small by a part of the corn having been inadvertently cut down and shocked, just before. The ears were shelled when gathered; and the products, measured in a vessel which held (by trial) 1-80th of a bushel, were as follows:

On land not marled,

4 rows, average 5 feet, and 50 in length, (500 square feet) 13½ measures,
or to the acre, - - - - - 7¼ bushels.

On adjoining marled land

4 rows, average 5 feet 1½ inches by 50 feet=512 square feet, 25¾ measures,
or to the acre, - - - - - 13½ bushels.

4 next rows, 5 feet 4½ inches by 50=537 square feet, 27½ measures,
or to the acre, - - - - - 14 bushels.

1829. In wheat.

1830. At rest—the weeds, a scanty cover.

1831. In corn. October 20th—measured by the chain equal spaces, and gathered and measured their products. The corn not marled was so imperfectly filled, that it was necessary to shell it, for fairly measuring the quantity. The marled parcels, being of good ears generally, were measured as usual, by allowing two heaped measures of ears, for one of grain.

On land not marled,

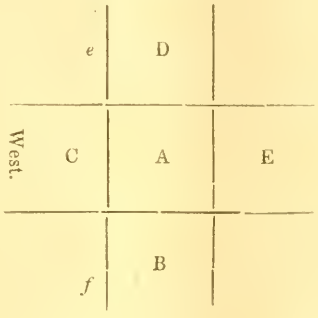
363 square yards made - - - - - - - - 3 gallons,
or to the acre, - - - - - - - - 5 bushels.

On marled land, close adjoining on one side,
363 square yards made rather more than 6 gallons—to the acre, 10 bushels.
363 square yards on another side, made not quite 8 gallons,
or to the acre, - - - - - - - - - 12 bushels.

The piece not marled coincided with that measured in 1828, as nearly as their difference of size and shape permitted—as did the last named marled piece, with the two of 1828. The last crop was greatly injured by the wettest summer that I have ever known, which has caused the decrease of product exhibited in this experiment—which will be best seen in this form:

	Product of grain to the acre.	
	1828—October 18.	1831—October 20.
Not marled, - - -	7 bushels 1 peck.	- 5 bushels.
Marled, (averaged,) -	- 13 " 3 "	- 11 "

Experiment 6.



The remainder of the thirty acres was grubbed during the winter of 1826--7—marled the next summer at five hundred to six hundred bushels the acre; marl 40 per cent. A rectangle (A) 11 by 13 poles, was laid off by the chain and compass, and left without marl. All the surrounding land supposed to be equal in quality with A—and all level, except on the sides E and B, which were partly sloping, but not otherwise different. The soil suited to the general description given before; no material difference known or suspected between the land on which 5th experiment was made and this, except that the latter had not been robbed of any wood for fuel, before clearing. The large trees (or all more than ten inches through,) were belted, and the smaller cut down in the beginning of 1828, and all the land west of the line *e f* was planted in corn. As usual, the tillage bad, and the crop very small. The balance lying east of *e f*, was coultered once, but as more labor could not be spared, nothing more was done with it until the latter part of the winter, 1829, when it was broken by two-horse ploughs, oats sown and covered by trowel ploughs—then clover sown, and a wooden-tooth harrow passed over to cover the seed, and to smooth down, in some measure, the masses of roots and clods.

Results, 1829. The oats produced badly—but yielded more for the labor required than corn would have done. The young clover on the marled land was remarkably good, and covered the surface completely. In the unmarled part, A, only two casts through had been sown, for comparison, as I knew it would be a waste of seed. This looked as badly as had been expected.

1830. The crop of clover would have been considered excellent even on good land, and was most remarkable for so poor a soil as this. The strips sown through A, had but little left alive, and that scarcely of a size to be observed, except one or two small tufts, where I supposed some marl had been deposited by the cleaning of a plough, or that ashes had been left, from burning the brush. The growth of clover was left undisturbed until after midsummer, when it was grazed by my small stock of cattle, but not closely.

1831. Corn on the whole field. October 20th, measured carefully half an acre (10 by 8 poles) in A, the same in D, and half as much (10 by 4) in E. No more space could be taken on this side, for fear of getting within the injurious influence of the contiguous woods. No measurement was made on the side B, because a large oak, which the belting had not killed, affected its product considerably. Another accidental circumstance prevented my being able to know the product of the side C, which however was evidently and greatly inferior to all the marled land on which oats and clover had been raised. This side had been in corn, followed by wheat, and next (1830) under its spontaneous growth of weeds. The corn on each of the measured spaces was cut down, and put in separate shocks—and on Nov. 25th, when well dried, the parcels were shucked and measured, before being moved. We had then been gathering and storing the crop for more than fifteen days—and therefore these measurements may be considered as showing the amount of dry and firm grain, without any unusual deduction being required for shrinkage.

		Bushels.	Pecks.
A (half acre) made	7¼ bushels of ears, or of grain to the acre,	7	1
D (half acre)	16¾ - - - - - - -	16	3
E (quarter acre)	11 - - - - - - -	22	

The sloping surface of the side E, prevented water from lying on it, and therefore it suffered less, perhaps not at all, from the extreme wetness of the summer, which evidently injured the growth on A and D, as well as of all the other level parts of the field.

1832. The field in wheat.

1833. In clover, which was grazed, though not closely, after it had reached its full growth.

1834. Corn, a year earlier than would have been permitted by the four-shift rotation. The tillage was insufficient, and made still worse by the commencement of severe drought before the last ploughing was completed, which was thereby rendered very laborious, and imperfect withal. The drought continued through all August, and greatly injured the whole crop of corn.

Results continued. October 22d. Marked off by a chain half an acre within the space A (8 by 10 poles) as much in D, and a quarter acre (10 by 4 poles) in each of the other three sides C, B, and E, having each of the last four spaces as near as could be to the outlines of the space A. The products carefully measured (in the ears) yielded as follows:

A, not marled, yielded	6	bush.	0½	peck of grain,	to the acre.
D, marled,	"	19	"	3½	"	"
E, do.	"	20	"	1	"	"
C, do.	"	20	"	2	"	"
B, do.	"	20	"	1½	"	"

In comparing these products with those of the same land in 1831, stated above, it should be remembered that the corn formerly measured was dry, while that of the last measurement had yet to lose greatly by shrinking. As after early gathering, the corn from the poorest land of course will lose

most by drying, and as the ears on A were generally very defective and badly filled, if the measurement had been made in the sound and well dried grain of each parcel, the product of A could not have exceeded one-fourth of that of the surrounding marled land, and probably was less.

But though these differences of product present the improvement caused by marling in a striking point of view, this close and stubborn soil at best is very unfit for the corn crop; and its highest value is found under clover, and in wheat on clover, of which some proofs will be found in the next experiment. The first crop of clover, however, after marling, has not since been equalled.

My subsequent distant residence prevented my observing this field when under any matured crop, until in 1842, when in wheat. The growth on the unmarled space was certainly not more than one fourth as much as that of the surrounding ground.

Experiment 7.

Another piece of land of twenty-five acres, of soil and qualities similar to the last described, (Exp. 5 and 6,) was cleared in 1818, and about six acres marled in 1819, at about three hundred and fifty bushels. The course of cultivation was as follows:

1820—Corn—benefit from marl very unequal—supposed to vary between twenty-five and eighty per cent.

1821. Wheat—the benefit derived greater.

1822. At rest.

1823. Ploughed early for corn, but not planted. The whole marled at the rate of six hundred bushels (40 per cent.) again ploughed in August, and sown in wheat in October. The old marled space more lightly covered, so as to make the whole nearly equal.

1824. The wheat much improved.

1825 and 1826, at rest.

1827. Corn.

1828. In wheat, and sown in clover.

1829. The crop of clover was heavier than any I had ever seen in this part of the country, except in some very rare cases of rich natural soil, where gypsum was used and acted well. The growth was thick, but unequal in height, (owing probably to unequal spreading of the marl,) standing from fifteen to twenty-four inches high. The first growth was mowed for hay, and the second left to manure the land.

1830. The clover not mowed. Fallowed in August, and sowed wheat in October, after a second ploughing.

1831. The wheat was excellent, almost heavy enough to be in danger of lodging. I supposed the product to be certainly twenty bushels, perhaps twenty-five, to the acre.

As it had not been designed to make any experiment on this land, the progress of improvement was not observed with much care. But whatever were the intermediate steps, it is certain that the land, at first, was as poor as that forming the subjects of the two preceding experiments in the unimproved state, (the measured products of which have been given,) and that its last crop was at least four times as great as could have been obtained, if marl had not been applied. The peculiar fitness of this kind of soil for clover after marling, and the supposed cause of the remarkable heavy *first* crop of clover, will require further remarks, and will be again referred to hereafter.

CHAPTER IV.

THE EFFECTS OF CALCAREOUS MANURES ON ACID SOILS REDUCED BY CULTIVATION.

Proposition 5—continued.

My use of marl has been more extensive on impoverished acid soils than on all other kinds, and has never failed to produce striking improvement. Yet it has unfortunately happened that the two experiments made on such land with most care, and on which I relied mainly for evidence of the durable and increasing benefit from this manure, have had their effects almost destroyed by the applications having been made too heavy. These experiments, like the 4th and 6th, already reported, were designed to remain without any subsequent alteration, so that the measurement of their products, once in every succeeding rotation, might exhibit the progress of improvement under all the different circumstances. As no danger was then feared from such a course, marl was applied heavily, that no future addition might be required; and for this reason, I have to report my greatest disappointments exactly in those cases where the most evident success and increasing benefits had been expected. However, these failures will be stated fairly, and as fully as the most successful results; and they may at least serve to warn from the danger of error, if not to show the greatest profits of judicious marling.

It should be observed that the general rotation of crops pursued on the farm, on all land not recently cleared, was that of four shifts, (corn, wheat, and then the land two years at rest and not grazed,) though some exceptions to this course may be remarked in some of the experiments to be stated.

Experiment 8.

Of a poor sandy acid loam, seven acres were marled at the rate of only ninety bushels (37 per cent.) to the acre; laid on and spread early in 1819.

Results, 1819. In corn—the benefit too small to be generally perceptible, but could be plainly distinguished along part of the outline, by comparing with the part not marled.

1820. Wheat—the effect something better—and continued to be visible on the weeds following, until the whole was more heavily marled in 1823.

Experiment 9.

In the same field, on soil as poor and more sandy than the last described, four acres were marled at one hundred and eighty bushels, (37 per cent.) March 1818. A part of the same was also covered heavily with rotted barnyard manure, which also extended through similar land not marled. This furnished for observation, land marled only—manured only—marled and manured—and some without either. The whole space, and more adjoining, had been heavily manured five or six years before by summer cowpens, and stable litter—of which no appearance remained after two years.

Results, 1819. In corn. The improvement from marl very evident—but not to be distinguished on the part covered also by manure, the effect of the latter so far exceeding that of the marl as to conceal it.

1820. In wheat. In 1821 and 1822, at rest.

1823. In corn—5½ by 3¼ feet. The following measurements were made

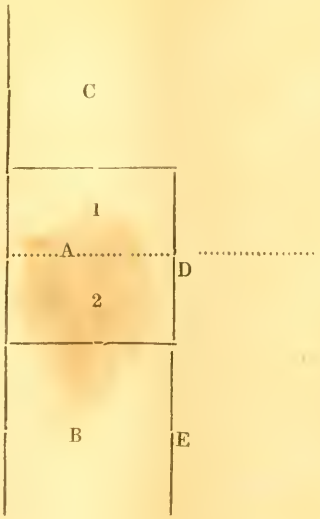
on adjoining spaces on October 10th. The shape of the ground did not admit of larger pieces, equal in all respects, being measured, as no comparison of products had been contemplated at first, otherwise than by the eye.

			Bush.	Quarts.
From the part not marled,	414	corn-hills made 75 quarts— or per acre,	13	26
Marled only,	414	- - - - - 100 -	18	12
Manured only,	490	- - - - 105 -	15	5
Marled and manured,	490	- - - 130 -	20	20

The growth on the part both marled and manured was evidently inferior to that of 1819. This was to be expected, as the small quantity of calcareous earth was not enough to fix half so much putrescent manure; and, of course, the excess was as liable to waste as if no marl had been used.

Experiment 10.

Twenty acres of sandy loam, on a sandy sub-soil, covered in 1819 with marl of about 30 per cent. average proportion of calcareous earth, and the balance silicious sand—at 800 bushels to the acre. This land had been long cleared, and much exhausted by cultivation; since 1814 not grazed, and had been in corn only once in four years; and, as it was not worth sowing in wheat, had three years in each rotation to rest and improve by receiving all its scanty growth of weeds. The same course has been continued from 1819 to 1832, except that wheat has regularly followed the crops of corn, leaving two years of rest in four. This soil was lighter than the subject of any preceding experiment, except the 9th. On a high level part, surrounded by land apparently equal, a square of about an acre (A) was staked off, and left without marl—which that year's work brought to two sides of the square (C, D and E.)



Results, 1820. In corn. October 13th, three half acres of marled land were measured, and as many on that not marled, and close adjoining, and produced as follows:

Not marled.	Bush.	Pecks.	*Marled.*	Bush.	Pecks.
Half acre in A,	7	1	adjoining in C,	12	3
The same in A,	7	1	" " D,	13	$3\frac{3}{4}$
Half acre in B,	7	$2\frac{1}{2}$	" " E,	15	$0\frac{1}{2}$

The average increase being $12\frac{1}{2}$ bushels of grain to the acre, nearly 100 per cent. as measured, and more than 100 if the defective filling, and less matured state of the corn not marled, be considered. The whole would have lost more by shrinkage than is usual from equal products.

1821. The whole in wheat; much hurt by the wetness of the season. The marled part more than twice as good as that left out.

1822 and 1823. At rest. A good cover of carrot weeds and other kinds had succeeded the former growth of poverty grass and sorrel, and every appearance promised additional increase to the next cultivated crop. November, 1823, when the next ploughing was commenced, the soil was found to be evidently deeper, of a darker color and firmer, yet more friable. The two-horse ploughs with difficulty (increased by the cover of weeds,) could cut the required depth of five inches, and the slice crumbled as it fell from the mould-board. But as the furrows passed into the part not marled, an immediate change was seen, and even *felt* by the ploughman, as the cutting was so much more easy, that care was necessary to prevent the plough running too deep—and the slices turned over in flakes, smooth and sleek from the mould board, like land too wet for ploughing, which however was not the case. The marling of the field was completed at the same rate, (800 bushels,) which closed a third side (B) of the marked square. The fourth side was my neighbor's field.

1824. In corn. The newly marled (on B) showed as early and as great benefit as was found in 1820 on C and D—but yet was very inferior to the old, until the latter was 10 or 12 inches high, when it began to give the first known evidence of the very injurious effects of using this manure too heavily. The disease thus produced became worse and worse, until many of the plants had been killed, and still more were so stunted as to leave no hope of their being otherwise than barren. The effects will be known from the measurements which were made as nearly as could be on the same ground as the corresponding marks in 1820, and will be exhibited in the table, together with the products of the succeeding rotations. Besides the general injury suffered here in 1824, there were one hundred and three corn hills in one of the measured quarter acres (in C,) or more than one-sixth, entirely barren, and eighty-nine corn hills in another quarter acre (D.) In counting these, none of the missing hills were included, as these plants might have perished from other causes. This unlooked for disaster diminished the previous increase gained by marling, by nearly one-half; and the damage has since been still greater, at each successive return of cultivation until some years after 1832.

Just before planting the crops of 1832, straw and chaff very imperfectly rotted by exposure, and which contained no admixture of animal manure, were applied at the rate of 800 bushels the acre to half the square without marl (A, 1) and to the adjacent parts of the marled land. The vegetable manure showed but slight benefit, until after all the worst effects of excessive marling had been produced; and the later operation of the manure served barely to prevent a still farther diminution being exhibited by the land injured by marl.

MARK.	DESCRIPTION.	PRODUCT IN SHELLED CORN PER ACRE.							
		1st course 1820. Oct. 13.		2d course 1824. October 16.		3d course 1828. October 13.		4th course 1832. October 19.	
		Bush.	pk.	Bush.	pecks.	Bush.	pecks.	Bush.	pecks.
A	Not marled	14	2	16	1	11	3½	9	3
A 1	After manuring,							16	3
B	Not marled until 1823,	15	1	28		19	2	not measured.	
C	Marled in 1819—manured with chaff, &c. in 1832.	25		19	2	15		18	
D		27	3½	20		19		19	½
E		30	1	not measured		not measured.		not measured.	

The crops of wheat were throughout less injured by the excess of marl than the corn.

For the crop of 1828, ploughed with three mules to each plough, from six to seven inches deep—seldom turning up any subsoil, (which was formerly within three inches of the surface,) and the soil appearing still darker and richer than when preparing for the crops of 1824. The ploughing of the square not marled (A) no where exceeded six inches; yet that depth must have injured the land, as I can impute to no other cause the remarkable diminution of product, through four courses of the mild four-shift rotation. It was evident that a still greater depth of furrow was not hurtful to the marled land. A strip across the field, in another place, was in 1828 ploughed eight inches deep for experiment, by the side of another of four inches, and the corn on the deepest ploughing was the best. Another strip was trench-ploughed twelve inches deep, without showing any perceptible difference, either of product or in the effects of damage from the excess of marl.

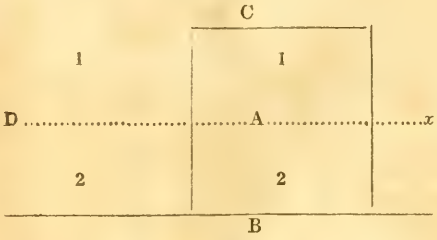
This square left without marl was the land previously referred to (page 27) as showing a diminished product through three successive courses of the rotation recommended by the author of 'Arator' as enriching. Since, another crop has been made and measured, and found to be still smaller than any previous. To whatever cause this continued falling off, for 16 years, may be attributed, it is at least a remarkable contradiction to the doctrine of vegetable matter serving alone to make poor land rich.

Much trouble has been encountered in attending to this experiment, and much loss of product submitted to, since its commencement, for the purpose of knowing the progress and extent of the evil caused by the excess of marl. But another portion of the field, marled as heavily in 1824, and where equal damage was expected to ensue, has been entirely relieved by intermitting the corn crop of 1828, sowing clover, which (by manuring with gypseous earth, or green-sand earth, at 20 bushels to the acre,) produced well, and which was left to fall and rot on the land. The next growth of corn on this part of the field (1832) was free from disease, and though irregular, seemed to the eye to amount to full twenty-five bushels to the acre.

After 1836, the rotation and management of this field ceased to be regular or uniform, as previously; and also, by cross ploughing, &c., during so many years, marl had necessarily become slightly diffused over the space designed to remain without marl. Therefore no more measurements were made, as they could no longer be relied on for accurate comparison. The unmarled part, even with its slight accidental gain of marl from the surrounding ground, and half the piece having also been dressed with putrescent manure in 1832, (as stated above,) is but very little improved since 1820.

Experiment 11.

The ground on which this experiment was made was in the midst of nineteen or twenty acres of soil apparently similar in all respects—level, gray sandy loam, cleared about thirty years before, and reduced as low by cultivation as such soil could well be. The land that was marled and measured was about two hundred yards distant from experiment 2, and both places are supposed to have been originally similar in all respects. This land had not been cultivated since 1815, when it was in corn—but had been once ploughed since, in November, 1817, which had prevented broom grass from taking possession. The ploughing then was four inches deep, and in five and a half feet beds, as recommended in 'Arator.' The growth in the year 1820 presented little except poverty grass, (*Aristida gracilis*,) running blackberry briers, and sorrel—and the land seemed very little if at all improved by its five successive years of rest. A small part of this land was covered with calcareous sand, (20 per cent.,) quantity not observed particularly, but probably about 600 bushels.



Results. 1821. Ploughed level, and planted in corn—distance $5\frac{1}{2}$ by $3\frac{1}{2}$ feet. The measurement of spaces nearly adjoining, made in October, was as follows:

23 by 25 corn hills, not marled, (in A) made $2\frac{1}{8}$ bushels, or per acre, - - - - - - - $8\frac{3}{8}$ } very nearly.
23 by 25 corn hills, marled, (on the side B) $5\frac{5}{8}$ $22\frac{1}{8}$ }

1822. At rest. Marled the whole, except a marked square of fifty yards, containing the space measured the preceding year. Marl 45 per cent. and finely divided—350 bushels to the acre—from the same bed as that used for experiment 4. In August, ploughed the land, and sowed wheat early in October.

1823. Much injury sustained by the wheat from Hessian fly, and the growth was not only mean, but very irregular; but it was supposed that the first marled place (on the side B) was from 50 to 100 per cent. better than the last marled, and the last superior to the included square not marled, (A) in as great a proportion.

1824. Again in corn. The effects of disease from marling were as injurious here, both on the new and old part, as those described in experiment 10. No measurement of products made, owing to my being from home when the corn was cut down for sowing wheat.

1825. The injury from disease less on the wheat than on the corn of the last year on the latest marling, and none perceptible on the oldest application. This scourging rotation of three grain crops in four years was particularly improper on marled land, and the more so on account of its poverty.

1826. White clover had been sown thickly over forty-five acres, including this part, on the wheat, in January, 1825. In the spring of 1826,

it formed a beautiful green though low cover to even the poorest of the marled land. Marked spots, which were so diseased by over-marling as not to produce a grain of corn or wheat, produced clover at least as good as other places not injured by that cause. The square, which had been sown in the same manner, and on which the plants came up well, had no clover remaining by April, 1826, except on a few small spots, all of which together would not have made three feet square. The piece not marled, white with poverty grass, might be seen, and its outlines traced, at some distance, by its strong contrast with the surrounding dark weeds in winter, or the verdant turf of white clover the spring before.

1827. Still at rest. No grazing allowed on the white clover.

1828. In corn—the land broken in January, five inches deep. October 14th, made the following measurements:

In the square not marled, (A) 105 by 104½ feet (thirty-six square yards more than a quarter of an acre,) made one barrel of ears—

	Bushels.	pecks.
Or of grain to the acre,	9	1¾
The same in 1821,	8	1½
Gain,	1	0¼
Old marling (in B)—105 by 104½ feet—2¼ barrels,	22	2
The same in 1821,	22	0½
Gain,		1½

New marling, 105 by 104½ feet, on the side that seemed to be the most diseased, (D) 1⅓ barrels—or nearly 12 bushels to the acre.

1832. Again in corn. Since 1826, the mild four-shift rotation had been regularly adhered to. Ploughed early in winter five inches deep, and again with two-horse ploughs just before planting, and after manuring the land above the dotted line D *x*. The manure was from the stable yard, the vegetable part of it composed of straw, corn-stalks, corn-cobs, and leaves raked from wood-land, had been heaped in a wet state a short time before, and was still hot from its fermentation when carrying to the field. It was then about half rotted. The rate at which it was applied was about 807 heaped bushels to the acre, which was too heavy for the best net profit. The corn on the oldest marling (B) showed scarcely a trace of remaining damage, while that on D 2 (not manured) was again much injured. On the manured part, D 1, and C, the symptoms of disease began also to show early—but were so soon checked by the operation of the putrescent manure, that very little (if any) loss could have been sustained from that cause. The following table exhibits all the measured products for comparison:

MARKS	DESCRIPTION.	PRODUCT IN GRAIN, PER ACRE. 1st course 1821. Oct. —	2d course 1824.	3d course 1828. Oct. 14.	4th course 1832. Oct. 20.
		Bush. pk.		Bush. pk	Bush. pk.
A	Not marled,	8 1½	None measured, but the product of B much reduced by excess of marl, and D & C equally injured from the same cause.	9 1¾	9 2½
A 1	Not marled & manured in 1832			the same	23 3
C	Marled in 1822, and manured in 1832.				31 1½
B	Marled in 1821 (lightly)	22 0½		22 2	25
D	Marled in 1822 (more heavily)			12	17 3
D 1	The same—and manured in 1832.			the same	34 3

The products of the spaces A and B, in 1828, were not only estimated as usual from the measurement of the corn in ears, (which estimated quantities are those in the table,) but they were also shelled on the day when gathered, and the grain then measured, and again some months after, when it had become thoroughly dry. Care was taken that there should be no waste of the corn, or other cause of inaccuracy. The result showed nearly double the loss from shrinking in the corn not marled, and of course a proportional greater comparative increase of product in that marled, besides the increase which appears from the early measurement exhibited in the table. The grain of A, not marled, when first shelled, measured a very little more than the quantity fixed by estimate—made as usual by measurement of the ears, and lost by shrinking 30 per cent. The marled grain, from B, measured at first above 4 per cent. more than the estimate, and after shrinking, fell below it so much as to show the loss to be 16 per cent. The loss from shrinking in this case was greater than usual in both, from the poverty and consequent backwardness of the part not marled, and the uncommonly large proportion of replanted and of course late corn on the whole.

The two last experiments, as well as the 4th, were especially designed to test the amount of increased product to be obtained from marling, and to show the regular addition to the first increase, which the theory promised at each renewal of tillage. As to the main objects, all the three experiments have proved failures—and from the same error, that of marling too heavily. Although for this reason, the results have shown so much of the injurious effects, still, taken altogether, the experiments prove, clearly, not only the great immediate benefit of applying marl, but also its continued and increasing good effects when applied in proper quantities.

Experiment 12.

On 9 acres of sandy loam, marled in 1819 at 400 bushels, (25 per cent.,) nearly an acre was manured during the same summer, by penning cattle. With the expectation of preserving the manure, double the quantity of marl, or 800 bushels in all, was laid on that part. The field in corn in 1820—in wheat, 1821—and at rest 1822 and 1823.

Results, 1824. In corn, the second rotation after marling. The effects of the dung have not much diminished, and that part shows no damage from the quantity of marl, though the surrounding corn, marled only half as thickly, gave signs of general, though very slight injury from that cause.

Experiment 13.

Nearly two acres of loamy sand were covered with barn-yard manure, and marl, (45 per cent.,) at the same time, in the spring of 1822, and the field put in corn the same year, followed by wheat. The quantity of marl not remembered—but it must have been heavy (say not less than six hundred bushels to the acre) as it was put on to fix and retain the manure, and I had then no fear of damage from heavy dressings.

Result, 1825. Again in corn—and except on a small spot of sand almost pure, (nearly a "blowing sand," or liable to be drifted by high winds in dry weather,) no signs of disease from over-marling were seen, then or afterwards.

CHAPTER V.

EFFECTS OF CALCAREOUS MANURES ON "FREE LIGHT LAND."

Proposition 5—continued.

The soil known in this part of the country by the name of "free light land" has so peculiar a character that it deserves a particular notice. It belongs to the slopes and undulating lands, between the highest ridges and the water courses, but has nothing of the durability which slopes of medium fertility sometimes possess. In its wood-land state it would be called rich, and may remain productive for a few crops after being cleared; but it is rapidly exhausted, and, when poor, seems as unimprovable by vegetable manures as the poorest ridge lands. In its virgin state, this soil might be supposed to deserve the name of neutral; but its productive power is so fleeting, and acid growths and qualities so surely follow its exhaustion, that it must be inferred that it is truly an acid soil.

Experiment 14.

The subject of this experiment presents soil of this kind with its peculiar characters unusually well marked. It is a loamy sandy soil, (the sand coarse,) on a similar sub-soil of considerable depth. The surface waving, almost hilly in some parts. The original growth principally red-oak, hickory, and dogwood, not many pines, and very little whortleberry. Cut down in 1816 and put in corn the next year. The crop was supposed to be twenty-five bushels to the acre. Wheat succeeded, and was still a better crop for so sandy a soil; making twelve to fifteen bushels, as it appeared standing. After 18 months of rest, and not grazed, the next corn crop, of 1820, was evidently and considerably inferior to the first; and the wheat of 1821 (which however was a very bad crop, from too wet a season) could not have been more than five bushels to the acre. In January, 1820, a piece of $1\frac{1}{2}$ acres was limed, at 100 bushels the acre. The lime, being caught by rain before it was spread, formed small lumps of mortar on the land, and produced no benefit on the corn of that year, but could be seen slightly in the wheat of 1821. The land again at rest in 1822 and '23, when it was marled, at 600 bushels, (37 per cent.,) without omitting the limed piece—and all sowed in wheat that fall. In 1824, the wheat was found to be improved by the marl, but neither that, nor the next crop of 1828, was equal to its earliest product of wheat. The limed part showed injury in 1824, from the quantity of manure, but none since. The field was now under the regular four-shift rotation, and continued to recover; but did not surpass its first crop until 1831, when it brought rather more than thirty bushels of corn to the acre (estimated by the eye,)—being five or six bushels more than its supposed first crop.

Experiment 15.

Adjoining this piece, six acres of similar soil were grubbed and belted in August, 1826—marl at 600 to 700 bushels (37 per cent.) spread just before. But few of the trees died until the summer of 1827. In 1828, planted in corn; the crop did not appear heavier than would have been expected if no marl had been applied—but no part had been left without, for comparison. 1829, wheat. 1830, at rest. 1831, in corn, and the product supposed to be near or quite thirty-five bushels, or an increase of thirty-five or forty

per cent. on the first crop. No measurement was made—but the product was estimated by comparison with an adjacent piece, which measured thirty-one bushels, and which seemed to be inferior to this piece.

The operation of marl on this kind of soil seems to add to the previous product very slowly, compared with other soils; but it is not the less effectual and profitable in fixing and retaining the vegetable matter accumulated by nature, which otherwise would be quickly dissipated by cultivation, and lost for ever.

The remarkable sandy and open texture of the soil on which the last two experiments were tried, will be evident from the following statement of the quantity and coarseness of the silicious sand contained.

1000 grains of this soil, taken in 1826 from the part that had been both limed and marled, was found to consist of

811 of silicious sand moderately coarse, mixed with a few grains of coarse shelly matter (the remains of the marl.)

158 finely divided earthy matter, part silicious, as well as aluminous, &c.

31 loss.

At the same time, from the edge of the adjoining wood-land which formed the next described experiment, 15, and which had not then been marled, a specimen of soil was taken from between the depths of one and three inches —and found to consist of the following proportions. This spot was believed to be rather lighter than the other in its natural state.

865 grains of silicious sand, principally coarse,

107 finely divided earthy matter (partly silicious,) &c.

28 loss.

CHAPTER VI.

EFFECTS OF CALCAREOUS MANURES ON EXHAUSTED ACID SOILS, UNDER THEIR SECOND GROWTH OF TREES.

Proposition 5—continued.

Not having owned much land under a second growth of pines, I can only refer to two experiments of this kind. The improvement in both these cases has been so remarkable, as to induce the belief that the "old fields" to be found on every farm, which have been exhausted and turned out of cultivation thirty or forty years, offer the most profitable subjects for the application of calcareous manures.

Experiment 16.

May 1826. Marled about eight acres of land under its second growth, by opening paths for the carts ten yards apart. Marl 40 per cent.; put 500 to 600 bushels to the acre—and spread in the course of the summer. In August, belted slightly all the pines that were as much as eight inches through, and cut down or grubbed the smaller growth, of which there was very little. The pines (which were the only trees) stood thick, and were mostly from eight to twelve inches in diameter—eighteen inches where standing thin. The land joined experiment 15 on one side; but this is level, and on the other side joins ridge woodland, which soon becomes like soil of experiment 1. This piece, in its virgin state, was probably of a nature between those two soils—but less like the ridge soil than the "free light land." No information has been obtained as to the state of this land

when its cultivation was formerly abandoned. The soil, (that is, the depth which has since been turned by the plough,) a whitish loamy sand, on a subsoil of the same; in fact, *all was subsoil* before the ploughing, except half an inch or three quarters, on the top, which was principally composed of rotted pine leaves. Above this thin layer were the later dropped and unrotted leaves, lying loosely several inches thick.

The pines showed no symptoms of being killed, until the autumn of 1827, when their leaves began to have a tinge of yellow. To suit the cultivation with the surrounding land, this piece was laid down in wheat for its first crop, in October, 1827. For this purpose, the few logs, the boughs, and grubbed bushes were heaped, but not burnt—the seed then sowed on the coat of pine leaves, and ploughed in by two-horse ploughs, in as slovenly a manner as may be supposed from the condition of the land; and a wooden-tooth harrow then passed over, to pull down the heaps of leaves, and roughest furrows.

Results. The wheat was thin, but otherwise looked well while young. The surface was very soon again covered by the leaves dropping from the then dying trees. On April 2d, 1828, most of the trees were nearly dead, though but few of them entirely. The wheat was then taller than any in my crop —and when ripe, was a surprising growth for such land, and such imperfect tillage.

1829 and 1830. At rest. Late in the spring of 1830 an accidental fire passed over the land—but the then growing vegetation prevented all of the older cover being burnt, though some was destroyed every where.

1831. In corn. The growth excited the admiration of all who saw it, and no one estimated the product so low as it actually proved to be. A square of four (two-pole) chains, or four-tenths of an acre, measured on November 25th, yielded at the rate of thirty-one and three-eighths bushels of grain to the acre.

Experiment 17.

In a field of acid sandy loam, long under the usual cultivation, a piece of five or six acres was covered by a second growth of pines thirty-nine years old, as supposed from that number of rings being counted on some of the stumps. The largest trees were eighteen or twenty inches through. This ground was altogether on the side of a slope, steep enough to lose soil by washing, and more than one old shallow gully remained to confirm the belief of the injury that had been formerly sustained from that cause. These circumstances, added to all the surrounding land having been continued under cultivation, made it evident that this piece had been turned out of cultivation because greatly injured by tillage. It was again cut down in the winter of 1824-5. Many of the trees furnished fence-rails and fuel, and the remaining bodies were heaped and burnt some months after, as well as the large brush. In August it was marled, supposed at 600 bushels, (37 per cent.,) twice coultered in August and September, and sowed in wheat—the seed covered by trowel ploughs. The leaves and much of the smaller brush left on the ground, made the ploughing troublesome and imperfect. The crop (1826) was remarkably good—and still better were the crops of corn and wheat in the ensuing rotation, after two years of rest. On the last crop of wheat (1830) clover was sown—and mowed for hay in 1831. The growth stood about eighteen inches high, and never have I seen so heavy a crop on sandy and acid soil, even from the heaviest dunging, the utmost care, and the most favorable season. The clover grew well in the bottoms of the old gullies, which were still plainly to be seen, and which no

means had been used to improve, except such as all the land had received. Within two feet of the surface the subsoil of this land is of red clay, which probably helped its growth of clover.

CHAPTER VII.

EFFECTS OF CALCAREOUS MANURES ALONE, OR WITH GYPSUM, ON NEUTRAL SOILS.

Proposition 5—continued.

Reason would teach that applications of calcareous earth alone to calcareous soils are so manifestly useless, that no more than two experiments of that kind have been made by me, neither of which had any improving effect that could be noticed, in the twelve ensuing years during which the experiments were observed.

When calcareous manures have been applied to neutral soils, whether new or worn, no perceptible and manifest benefit has been obtained on the first crop. The subsequent improvement has gradually increased, as would be expected from the power of fixing manures ascribed to calcareous earth. But however satisfactory these general results were to myself, they are not such as could be reported in detail, with any advantage to other persons. It is sufficiently difficult to make fair and accurate experiments where early and remarkable results are expected. But no cultivator of a farm can bestow enough care, and patient observation, to obtain true results from experiments that scarcely will show their first feeble effects in several years after the commencement. On a mere experimental farm, such things may be possible; but not where the main object of the farmer is profit from his general and varied operations. The effects of changes of season, of crops, of the mode of tillage—the auxiliary effects of other manures, and many other circumstances—would serve to defeat any observations of the progress of a slow improvement, though the ultimate result of the general practice might be abundantly evident.

Another cause for being unable to state with any precision the practical benefit of marling neutral soils, arises from the circumstance that nearly all the calcareous manure thus applied by me has been accompanied by a natural admixture of gypsum; and though I feel confident in ascribing some effects to one, and some to the other of these two kinds of manure, yet this division of operation must rest merely on opinion, and cannot be received as certain by any other than him who makes and carefully observes the experiments. Some of these applications will be described, that other persons may draw their own conclusions from them.

The cause of these manures being applied in conjunction was this. A singular bed of marl lying under Coggins Point, and the only one within a convenient distance to most of the neutral soil of that farm, contains a very small proportion (perhaps about one per cent.) of gypsum, scattered irregularly through the mass, seldom visible, though sometimes and very rarely to be met with in small crystals. The calcareous ingredient on a general average, carefully made, was found to be 62 per cent. If this manure had been used before its *gypseous* quality was discovered, all its effects would have been ascribed to calcareous earth alone, and the most erroneous opinions might thence have been formed of its mode of operation.

What led me to suspect the presence of gypsum, in this bed of fossil shells, was the circumstance that throughout its whole extent, of near a mile

along the river bank, this bed lies on another earth, of peculiar character and appearance, and which, in many places, exhibits gypsum in crystals of various sizes. This earth has evidently once been a bed of fossil shells, like what still remains above; but nothing now is left of the shells, except numerous impressions of their forms. Not the smallest proportion of calcareous earth can be found, and the gypsum into which it must have been changed (by meeting with sulphuric acid, or sulphuret of iron,) has also disappeared in most places; and in others, it remains only in small quantities —say from the smallest perceptible proportion, to fifteen or twenty per cent. of the mixed mass. In some rare cases, this gypseous earth is sufficiently abundant to be used profitably as manure, as has been done, by Mr. Thomas Cocke, of Tarbay, as well as myself. It is found in the greatest quantity, and also the richest in gypsum, at Evergreen, two miles below City Point. There the gypsum frequently forms large crystals of varied and beautiful forms. The distance that this bed of gypseous earth extends is about seven miles, interrupted only by some bodies of lower land, apparently of a more recent formation by alluvion.

In the bed of gypseous marl above described, there are regular layers of a calcareous rock, which was too hard to use profitably for manure, and which caused the greatest impediment to obtaining the softer part. This rock contains between eighty-five and ninety per cent. of pure calcareous earth, besides a little gypsum and iron. It makes excellent lime for cement, mixed with twice its bulk of sand, and has been used for part of the brickwork, and all the plastering of my present dwelling house, and for several of my neighbors' houses. The whole body of marl also contains a minute proportion of some soluble salts, which possibly may have some influence on the operation of the substance, as manure or cement.

Thus, from the examination of a single body of marl, there have been obtained not only a rich calcareous manure, but also gypsum, and a valuable cement. Similar formations may perhaps be abundant elsewhere, and their value unsuspected, and likely to remain useless. This particular body of marl has no outward appearance of possessing even its calcareous character. It would be considered, on slight inspection, as a mass of gritty clay, of no worth whatever.

The last preceding paragraphs present, as in the previous editions, my earliest views of this particular bed of marl. Further information has taught that it is of the *eocene*, or more ancient formation; and that the underlying stratum, (which is usually not at all calcareous,) which I formerly named and treated of as "gypseous earth," is what geologists call "greensand," a term still less descriptive, and not at all more accurate. A full account of both of these bodies will be given in the Appendix.

This gypseous marl has been used only on sixty acres, most of which was neutral soil, and generally, if not universally, with early as well as permanent benefits. The following experiments show results more striking than have been usually obtained; but all agree in their general character.

Experiment 18.

1819. Across the shelly island numbered 3 in the examinations of soils, (page 38,) but where the land was less calcareous, a strip of three quarters of an acre was covered with muscle-shell marl, a deposite on parts of the river banks supposed to have been made by the aboriginal inhabitants. Touching this, through its whole length, another strip was covered with gypseous marl, 53 per cent., at the rate of 250 bushels.

Results. 1819. In corn. No perceptible effect from the muscle shells. The gypseous marling considerably better than on either side of it.

1820. Wheat— less difference.

1821. Grazed. Natural growth of white clover thickly set on the gypseous marling, much thinner on the muscle-shells, and still less of it where no marl had been applied.

The whole field afterwards was put in wheat on summer fallow every second year, and grazed closely the intervening year— a course very unfavorable for observing, or permitting to take place, any effects of gypsum. Nothing more was noted of this experiment until 1825, when cattle were not turned in until the clover reached its full size. The strip covered with gypseous marl showed a remarkable superiority over the other marled piece, as well as over the land which was still more calcareous by nature, and which had produced better in 1820. In several places, the white clover stood thickly a foot in height.

Experiment 19.

A strip of a quarter acre passing through rich black neutral loam, covered with gypseous marl at 250 bushels.

Results. 1818. In corn. By July, the marled part seemed the best by 50 per cent., but afterwards the other land gained on it, and little or no difference was apparent when the crop was matured.

1819. Wheat—no difference seen.

1820 and 1821. At rest. In the last summer the marled strip could again be easily traced, by the entire absence of sorrel, (which had been gradually increasing on this land since it had been secured from grazing,) and still more by its very luxuriant growth of bird-foot clover, which was thrice as good as that on the adjoining ground.

Experiment 20.

1822. On a body of neutral soil which had been reduced quite low, but was well manured in 1819 when last cultivated, gypseous marl was spread on nine acres, at the rate of 300 bushels. This terminated on one side at a strip of muscle-shell marl ten yards wide— its rate not remembered, but it was certainly thicker in proportion to the calcareous earth contained, than the other, which I always avoided laying on heavily, from a mistaken fear of causing injury by too much gypsum. The line of division between the two marls was through a clay loam. The subsoil was a retentive clay, which caused the rain water to keep the land very wet through the winter, and early part of spring.

Results. 1822. In corn, followed by wheat in 1823—not particularly noticed, but the benefits must have been very inconsiderable. All the muscle-shell marling, and four acres of the gypseous, sowed in red clover, which stood well, but was severely checked, and much of it killed, by a drought in June, when the sheltering wheat was reaped. During the next winter (by neglect) my horses had frequent access to this piece, and by their trampling in its wet state must have injured both land and clover. From these disasters the clover recovered surprisingly; and in 1824, two mowings were obtained, which, though not heavy, were better than from any of my previous attempts to raise this grass. In 1825, the growth was still better, and yielded more to the scythe. This was the first time that I had seen clover worth mowing on the third year after sowing—and had never heard of its being comparable to the second year's growth any where in the lower country. The growth on the muscle-shell marling was very inferior

to the other, and was not mowed at all the last year, being thin and low, and almost eaten out by wire-grass, (*Cynodon dactylon.*)

1826. In corn—and it was remarkable that the difference shown the last year was reversed, the muscle-shell marling now having much the best crop.

In these and other applications to neutral soils, I ascribe the earliest effects entirely to gypsum, as well as the peculiar benefit shown to clover, throughout. The later effects, and especially on grain, are due to the calcareous earth in the manure.

CHAPTER VIII.

DIGRESSION TO THE THEORY OF THE ACTION OF GYPSUM AS MANURE. SUPPOSED CAUSE OF ITS WANT OF POWER AND VALUE ON ACID SOILS.

Proposition 5—continued.

Another opinion was formed from the effects of gypseous marl, as stated in the foregoing chapter, which may lead to profits much more important than any to be derived from the limited use of this, or any similar mineral compound—viz.: *that gypsum may be profitably used after calcareous manures, on soils on which it was totally inefficient before.* I do not present this as a fact fully established, or, even if established, of universal application; for the results of some of my own experiments are directly in opposition. But, however it may be opposed by some facts, the greater weight of evidence, furnished by my experiments and observations, decidedly supports this opinion. If correct, its importance to our low country is inferior only to the value of calcareous manures alone—which value may be almost doubled, if the land is thereby fitted to receive the wonderful benefits of gypsum and clover.

It is well known that gypsum has failed entirely as a manure on nearly all the land on which it has been tried in our tide-water district; and we may learn from various publications, that as little general success has been met with along the Atlantic coast, as far north as Long Island. To account for this general failure of a manure so efficacious elsewhere, some one offered a reason, which was received without examination, and which is still considered by many as sufficient, viz.: that the influence of salt vapors destroyed the power of gypsum on and near the sea-coast. But the same general worthlessness of that manure extends one hundred miles higher than the salt water of the rivers—and the lands where it is profitably used are much more exposed to sea air. Such are the rich neutral soils of Curle's Neck, Shirley, Berkley, Brandon, and Sandy Point, on James river, on all which gypsum on clover has been extensively and profitably used. On acid soils, I have never heard of enough benefit being obtained from gypsum to induce the cultivator to extend its use further than making a few small experiments. When any effect has been produced on an acid soil, (so far as instructed by my own experience, or the information of others,) it has been caused by applying to small spaces comparatively large quantities; and even then, the effects were neither considerable, durable, nor profitable. Such have been the results of many small experiments made on my own acid soils—and very rarely was the least perceptible effect produced. Yet on some of the same soils, after marling, the most evident benefits have been obtained from gypsum on clover. The soils on which the 1st and 10th experiments were made, (at some distance from these

experiments,) had both been tried with gypsum, and at different rates of thickness, before marling, without the least effect. Several years after both had been marled, gypseous earth (from the bed referred to, page 93,) was spread at twenty bushels the acre, (which gave four bushels of pure gypsum,) on clover, and produced in some parts a growth I have never seen surpassed. It is proper to state that such results have been produced only by heavy dressings. Mr. Thomas Cocke, of Tarbay, in the spring of 1831 sowed nearly four tons of Nova Scotia gypsum on clover on marled land, the field being a continuation of the same ridge that my 1st, 2d, 3d, and 4th experiments were made on, and very similar soil. His dressing, at a bushel to the acre, before the summer had passed, produced evident benefit, where it is absolutely certain, from abundant previous experience, that none could have been obtained before marling.

On soils naturally calcareous, I have in some experiments greatly promoted the growth of corn by gypsum, and have doubled the growth of clover on my best land of that kind. When the marl containing gypsum was applied, benefit from that ingredient was almost certain to be obtained.

All these facts, if presented alone, would seem to prove clearly the correctness of the opinion, that the acidity of most of our soils caused the inefficacy of gypsum, and that the application of calcareous earth, which will remove the acid, will also serve to bring gypsum into useful operation. But this most desirable conclusion is opposed by the results of other experiments, which, though fewer in number, are as strong as any of the facts that favor that conclusion. If the subject were properly investigated, those facts, apparently in opposition, might be explained so as no longer to contradict this opinion, or perhaps might help to confirm it. Good reasons, deduced from established chemical truths, may be offered to explain why the acidity of our soils should prevent the operation of gypsum; though it may be deemed premature to attempt the explanation of any supposed fact, before every doubt of the existence of the fact itself has been first removed.

One of the circumstances will be mentioned, which appears at first glance most strongly opposed to the opinion which has been advanced. On the poor acid clay soil, of such peculiar and base qualities, which forms the subject of the 5th, 6th, and 7th experiments, gypsum has been sufficiently tried, and has not produced the least benefit, either before marling, or afterwards. Yet the first growth of clover on this land after marling is fully equal to what might be expected from the best operation of gypsum. Now if it could be ascertained that a very small proportion of either *sulphuric acid*, or of the *sulphate of iron*, exists in this soil, it would completely explain away this opposing fact, and even make it the strongest support of my position. The sulphate of iron has sometimes been found in arable soil,* and sulphuric acid has been detected in certain clays.† I have seen, on the same farm, a bed of clay of very similar appearance to this soil, which certainly had once contained one of these substances, as was proved by the formation of crystallized sulphate of lime, where the clay came in contact with a bed of marl. The sulphate of lime was found in the small fissures of the clay, extending sometimes one or two feet in perpendicular height from the calcareous earth below. Precisely the same chemical change would take place in a soil containing sulphuric acid, or sulphate of iron, as soon as marl is applied. The sulphuric acid, (whether free or combined with iron) would immediately unite with the lime presented, and form gypsum, (sulphate of lime.) Proportions of these substances, too small perhaps to be detected by analysis, would be sufficient to form three

* Agr. Chem. p 141. † Kirwan on Manures.

or four bushels of gypsum to the acre - more than enough to produce the greatest known effect on clover—and to prevent any benefit being derived from a subsequent application of gypsum; because there being already in the soil more gypsum than could act, no additional quantity could be of the slightest benefit.

Since the publication of the foregoing part of this chapter, in the first edition, my use of gypsum, on land formerly acid, has been more extended, and the results have been such as to give additional confidence in the practice, and, indeed, an assurance of good profit, on the average of such applications. But still, as before, disappointments, either total or nearly so, in the effect of such applications, have sometimes occurred, and without there being any known or apparent cause to which to attribute such disappointment in the results.

In 1832, nine acres of the same body of ridge land above referred to, adjoining the piece on which the 1st, 2d, 3d and 4th experiments were made, and more lately cleared, were sown in clover in the early part of 1831, on wheat. The next spring, French gypsum was sown at the rate of a bushel to the acre, except on four marked adjoining squares, each about one third of an acre, one of which was left without plaster, and the others received it at the several rates of 2, 3, and 4 bushels to the acre. The whole brought a middling crop, and was mowed for hay, except the square left without gypsum, which did not produce more than half as much as the adjoining land where gypsum was applied at one bushel the acre. The products of the other pieces were slightly increased by each addition to the gypsum, but by no means in proportion to the increased quantity used; nor was the effect of the four bushels near equal to that formerly obtained, in several cases, from 20 bushels of gypseous earth taken from the river bank. Hence it seems that it was not merely the unusual quantity of gypsum applied in this earth, which produced such remarkable benefit; and we must infer that it contains some other quality or ingredient capable of giving additional improvement to clover.

Since the first publication of the foregoing passage, (in 1832,) and in accordance with the views there presented, more than 10 tons of good French gypsum has been used, in different years and with less effect, in general, than formerly, in the first few years after the marling. This general diminution, and more frequent total failures, may be owing to the longer time that the land has been marled, and, by the increase of its vegetable supplies serving as putrescent manure, the land being thereby changed from calcareous to neutral, and perhaps in some cases even approaching to being acid. If this supposition be well founded, then a repetition of the marling would not only be profitable in other respects, but would increase or restore the capacity of the soil to receive benefit from gypsum.

The following are my views of the general causes of the inertness and worthlessness of gypsum as manure, on all acid soils, and for the different and valuable results from gypsum, after the soils have been made calcareous.

I do not pretend to explain the mode of operation by which gypsum produces its almost magical benefits; it would be equally hopeless and ridiculous for one having so little knowledge of the successful practice to attempt an explanation, in which so many good chemists and agriculturists, both scientific and practical, have completely failed. There is no operation of nature heretofore less understood, or of which the cause, or agent, seems so totally disproportioned to the effect, as the enormous increase of vegetable growth from a very small quantity of gypsum, in circumstances favorable to its action. All other known manures, whatever may be the nature of their action, require to be applied in quantities very far exceed-

ing any bulk of crop expected from their use. But one bushel of gypsum spread over an acre of land fit for its action, may add more than twenty times its own weight to a single crop of clover hay.

But without pretending to account for the wonderful action of gypsum as manure, and without entertaining any confidence in any of the numerous theories heretofore presented, (not excepting the latest set forth, by Professor Liebig,) I concur in the general opinion expressed by Davy. This accurate investigator, who took nothing upon trust which could be subjected to the test of rigid experiment, pursued that mode to obtain light on this obscure subject. He found by chemical analysis, that gypsum was always present in the ashes of red clover, and in quantity, in a good crop, amounting to three or four bushels to the acre. He inferred that gypsum, thus always forming a portion of the clover plant, was essential to its healthy existence—and that it is necessary to the structure of the woody fibre of clover and other grasses. But it is enough if Davy was correct in the main opinion, that a certain though very small proportion of gypsum is an essential component part of certain plants, of which the clover tribe furnishes the most noted examples. If this be so, no matter what may be the office or function of the gypsum, the small amount necessary for the demands of the plants *must be present in the soil*, or otherwise the plants needing it *cannot live, or maintain a healthy growth.* It will follow, further, that on soils well adapted for clover in other respects, but almost totally deficient in gypsum, the application of so small a dressing as one bushel of that substance to the acre may enable a full crop of clover to grow, and twice or thrice as much as the land could have brought without this small application. Such I suppose to be the circumstances of those lands of this country on which gypsum exerts the greatest power. But in England, though clover culture is universally extended, gypsum has shown scarcely any benefit as manure, and though extensively experimented with, has not been found sufficiently operative to be brought into ordinary practice on any one farm in the kingdom. This may be accounted for by supposing the soils generally to be supplied by nature abundantly with gypsum, so that no more is required. Davy found gypsum in the soil itself of four farms, examined with this view, and in one of them the very large proportion of nearly one per cent. (See Agricultural Chemistry, Lecture vii.) But there is another and numerous class of cases in which gypsum cannot be supposed to be present, and yet when applied shows no benefit. These are the poor acid soils of lower Virginia, (and elsewhere,) and the cause of which it seems to me not difficult to explain.

However wonderful and inscrutable the fertilizing power of this manure may be, and admitting its cause as yet to be hidden, and entirely beyond our reach—still it is possible to show reasons why gypsum cannot act in many situations, where all experience has proved it to be worthless. If this only can be satisfactorily explained, it will remove much of the uncertainty as to the effects to be expected; and the farmer may thence learn on which soils he may hope for benefit from this manure—on which it will certainly be thrown away—and by what means the circumstances adverse to its action may be removed, and its efficacy thereby secured. This is the explanation that I shall attempt.

If the vegetable acid, which I suppose to exist in what I have called acid soils, is not the oxalic, (which is the particular acid in sorrel,) at least every vegetable acid, being composed of different proportions of the same three elements, may easily change to any other, and all to the oxalic acid. This, of all bodies known by chemists, has the strongest attraction for lime, and will take it from any other acid which was before combined with it, and for

that purpose, the oxalic acid will let go any other earth or metal, which it had before held in combination. Let us then observe what would be the effect of the known chemical action of these substances, on their meeting in soils. If oxalic acid were produced in any soil, its immediate effect would be to unite with its proper proportion of lime, if enough were in the soil in any combination whatever. If the lime were in such small quantity as to leave an excess of oxalic acid, that excess would seize on the other substances in the soil, in the order of their mutual attractive force; and one or more of such substances are always present, as magnesia; or, more certainly, iron and alumina. The soil then would not only contain some proportion of the *oxalate of lime*, but also the oxalate of either one or more of the other substances named. Let us now suppose gypsum to be applied to this soil. This substance (sulphate of lime) is composed of sulphuric acid and lime. It is applied in a finely pulverized state, and in quantities from half a bushel to two bushels the acre—generally not more than one bushel. As soon as the earth is made wet enough for any chemical decomposition to take place, the oxalic acid must let go its *base* of iron, or alumina, and seize upon and combine with the lime that formed an ingredient of the gypsum. The sulphuric acid left free, will combine with the iron, or the alumina of the soil, forming copperas in the one case, and alum in the other. *The gypsum no longer exists*—and surely no more satisfactory reason can be given why no effect from it should follow. The decomposition of the gypsum has served to form two or perhaps three other substances. One of them, oxalate of lime, like all salts of lime, is probably valuable as manure, but the very small quantity that could be formed out of one or even two bushels of gypsum, might have no more visible effect on a whole acre, than that small quantity of calcareous earth, or farm-yard manure. The other substance certainly formed, copperas, is known to be a poison to soil and to plants—and alum, of which the formation would be doubtful, I believe is also hurtful. In such small quantities, however, the poison would be as little perceptible as the manure—and no apparent effect whatever could follow such an application of gypsum to an acid soil. So small a proportion of oxalic acid, or any oxalate other than of lime, would suffice to decompose and destroy the gypsum, that it would not amount to one part in twenty thousand of the soil.

Why gypsum sometimes acts as a manure on acid soils, when applied in large quantities for the space, is equally well explained by the same theory. If a handful, or even a spoonful of gypsum is put on a space of six inches square, it would so much exceed in proportion all the oxalic acid that could speedily come in contact with it, that all would not be decomposed, and the part that continued to be gypsum would show its peculiar powers perhaps long enough to improve one crop. But as tillage served to scatter these little collections more equally over the whole space—or even as repeated soaking rains allowed the extension of the attractive powers—applications like these would also be destroyed, after a very short-lived, limited, and rarely profitable action.

Soils that are naturally calcareous cannot contain oxalic acid combined with any other base than lime. Hence, gypsum applied there *continues to be gypsum*—and exerts its great fertilizing power, as in the counties of Loudoun and Frederick. But even on these most suitable soils, this manure is said not to be certain and uniform in its effects, and of course more certain results are not to be looked for with us. I have not undertaken to explain its occasional failures any more than its general success, on the lands where it is profitably used in general—but only why it cannot act at all, on lands of a different kind.

The same chemical action being supposed, explains why the power of profiting by gypsum should be immediately awakened on acid soils after making them calcareous—and why that manure should seldom fail, when applied mixed with much larger quantities of calcareous earth.

CHAPTER IX.

THE DAMAGE CAUSED BY TOO HEAVY DRESSINGS OF CALCAREOUS MANURE, AND THE REMEDY.

Proposition 5—continued.

The injury or disease in grain crops produced by marling has so lately been presented to our notice, that the collection and comparison of many additional facts will be required before its cause can be satisfactorily explained. But the facts already ascertained will at least show how to avoid the danger of such injury in future, and to find remedies for the evils already inflicted by the injudicious use of calcareous manures.

The earliest effect of this kind observed was in May, 1824, on the field containing experiment 10. The corn on the land marled four years before sprang up and grew with all the vigor and luxuriance that was expected from the appearance of increased fertility exhibited by the soil, as before described, (page 84.) About the 20th of May the change commenced, and the worst symptoms of the disease were seen by the 11th of June. From having as deep a color as young corn shows on the richest and best soils, it became of a pale sickly green. The leaves, when closely examined, seemed almost transparent, afterwards were marked through their whole length by streaks of rusty red, separated very regularly by other streaks of what was then more of yellow than green, and next they began to shrivel and die downwards from their extremities. The growth of many of the plants was nearly stopped. Still some few showed no sign of injury, and maintained the vigorous growth which they began with, so as by contrast more strongly to mark the general loss sustained. The appearance of the field was such, that a stranger would have supposed that he saw the crop on a rich soil exposed to the worst ravages of some destructive kind of insects; but neither on the roots or stalks of the corn could any thing be found to support that opinion. Before the first of August this gloomy prospect had somewhat improved. Most of the plants seemed to have been relieved of the infliction, and to grow again with renewed vigor. But before that time many were dead, and it was impossible that the others could so fully recover as to produce any thing approaching a full crop for the land. It has been shown in the report of the products of Exp. 10, what diminution of crop was then sustained—and that the evil was not abated in the three succeeding courses of cultivation. Still, neither of the diseased measured pieces has fallen quite as low as its product before marling; nor do I think that such has been the result on any one acre together on my farm, though many smaller spots have been rendered incapable of yielding even so much as a grain of corn or wheat.

The injury caused to wheat by marling is not so easy to describe, though abundantly evident to the observer. Its earliest growth, like that of corn, is not affected. About the time for heading, the plants most diseased appear as if they were scorched, and when ripe will be found very deficient in grain. On very poor spots, from which nearly all the soil has been washed, sometimes fifty heads of wheat, taken together, would not furnish

as many grains of wheat. This crop, however, suffers less than corn on the same land; perhaps because its growth is nearly completed by the time that the warm season begins, to which the ill effects of calcareous manures seem confined. The injury to corn is also greater in a wet than a drier summer.

When these unpleasant discoveries were first made, two hundred and fifty acres had already been marled so heavily that the same evil was to be expected to visit the whole. My labors, thus bestowed for years, had been greatly and unnecessarily increased—and the excess, worse than being thrown away, had served to take away that increase of crop which lighter marling would have ensured. But though much and general injury was afterwards sustained from the previous work, yet it was lessened in extent and degree, and sometimes entirely avoided, by the remedial measures which were adopted. My observation and comparison of all the facts presented, led to the following conclusions, and pointed out the course by which to avoid the recurrence of the evil, and the means to lessen or remove it, where it had already been inflicted.

1st. No injury has been sustained on any soil of my farm by marling not more heavily than two hundred and fifty heaped bushels to the acre, with marl of strength not exceeding 40 per cent. of calcareous earth.

2d. Dressings twice as heavy seldom produce damage to the first crop on any soil—and never even on the after crops on any calcareous, or good neutral soil—nor on any acid soil supplied plentifully with vegetable matter.

3d. On acid soils marled too heavily, the injury is in proportion to the extent of one or all these circumstances of the soil—poverty, sandiness, and severe cropping and grazing, whether inflicted previously or subsequently.

4th. Clover, both red and white, will live and flourish on the spots most injured for grain crops by marling too heavily. Thus, in the case before cited of land adjacent to the pieces measured in experiment 10, and equally over-marled, very heavy red clover was raised in 1830, by adding gypseous earth, and which was succeeded by a good growth of corn, free from every mark of disease, in 1832.

5th. A good dressing of putrescent manure removes the disease completely, (see Exp. 11, 12, 13.) All kinds of marl (or fossil shells) have sometimes been injurious—but such effects have been more generally experienced from the dry yellow marl, than from the blue and wet.

The inferences to be drawn from these facts are obvious. They direct us to avoid injury by applying marl lightly at first, and to be still more cautious according to the existence of the circumstances stated as increasing the tendency of marl to do harm. Next, if the over-dose has already been given, we should forbid grazing entirely, and furnish putrescent manure as far as possible—or omit one or two grain crops, so as to allow more vegetable matter to be fixed in the land—apply putrescent manures—and sow clover as soon as circumstances permit. One or more of these remedies have been used on most of my too heavily marled land; and with considerable, though not always with entire success, because the means for the cure could not always be furnished at once in sufficient abundance. Other persons, who permitted close grazing, and adopted a more scourging rotation of crops, have suffered more damage, from much lighter dressings of marl than those of mine which were injurious.

But though the unlooked-for damage sustained from this cause produced much loss and disappointment, and has greatly retarded the progress of my improvements, it did not suspend my marling, nor abate my estimate of the value of the manure. If a cover of 500 or 600 bushels was so strong as

to injure land of certain qualities, it seemed to be a fair deduction, that the benefit expected from so heavy a dressing, might have been obtained from half the quantity—if not on the first crop, at least on every one afterwards. *That* surely is nothing to be lamented. It also afforded some consolation for the evil of the too heavy marlings already applied, that the soil was thereby fitted to seize upon and retain a greater quantity of vegetable matter, and would thereby ultimately reach a higher grade of fertility.

The cause of this disease is less apparent than its remedies. It is certain that it is not produced merely by the quantity of calcareous earth in the soil. If it were so, similar effects, shown in diseased crops, would always be found on soils containing far greater proportions of that earth. These injurious effects have not been known, to any extent, except on soils formerly acid, and made calcareous artificially; and not on either neutral or calcareous soils, even by the addition of a great excess of marl. The small spots of land that nature has made excessively calcareous, and also sandy by marl beds cropping out at the surface of cultivated fields, (as the specimen 4, page 38,) produce indeed a pale feeble growth of corn, such as might be expected from poor gravelly soils—but whether the plants yield grain, or are barren, they show none of those peculiar and strongly marked symptoms of disease which have been described. Some such places on my farm, from which great quantities of poor sandy marl had been removed for manure, and where the remainder still was of unknown depth, have been afterwards cultivated with the surrounding land; and with no more aid than the portion of the adjacent soil carried thereto necessarily by the plough, these places have gradually improved to a product equal to 12 or 15 bushels of corn per acre, and have never exhibited any mark of the marl disease.

By calculation, it appears that the heaviest dressing causing injurious consequences, if mixed to the depth of five inches, has not given to the soil a proportion of calcareous earth equal to two per cent. This proportion is greatly exceeded in our best shelly land, and no such disease is found there, even when the rich mould is nearly all washed away, and the shells mostly left. Soils of remarkable fertility from the prairies of Alabama and Mississippi have been shown (page 43) to contain from 8 to 16 per cent. of calcareous earth, all of which proportions were in the state of most minute division, and therefore most ready to produce this disease, if it could have been produced by the quantity of this ingredient. The soil of the borders of the Nile, celebrated for its exuberant fertility through thousands of successive crops, contains about 25 per cent. of carbonate of lime. (*Lyell's Geology.*) Very fertile soils in France and England sometimes contain 20 or 30 per cent. Among the soils of remarkable good qualities analyzed by Davy, one is stated to contain about 28 per cent., and another, which was eight-ninths of silicious sand, contained nearly 10 per cent. of calcareous earth. Nor does he intimate that such proportions are very rare. Similar results have been stated, from analyses reported by Kirwan, Young, Bergman, and Rozier, (page 32,) and from all the same deduction is inevitable, that much larger natural proportions of calcareous earth, than our diseased lands have received, are very common in France and England, without any such effect being produced.

From the numerous facts of which these are examples, it is certain that calcareous earth acting alone, or directly, has not caused this injury; and it seems most probable that the cause is some new combination of lime formed in acid soils only; and that this new combination is hurtful to grain under certain circumstances, which we may avoid, and is highly beneficial to every kind of clover. Perhaps it is the *salt of lime*, formed by the calcareous manure combining with the acid of the soil, which not meeting with

enough vegetable matter to combine with and fix in the soil, causes, by its excess, all these injurious effects.

CHAPTER X.

RECAPITULATION OF THE EFFECTS OF CALCAREOUS MANURES, AND DIRECTIONS FOR THEIR MOST PROFITABLE APPLICATION.

Proposition 5—continued.

From the foregoing experiments may be gathered most of the effects, both injurious and beneficial, to be expected from calcareous manures, on the several kinds of soils there described. Information obtained from statements in detail of agricultural experiments, is far more satisfactory, to the attentive and laborious inquirer, than a mere report of the general opinions of the experimenter, derived from the results. But however preferable may be this mode of reporting facts, it is necessarily deficient in method, clearness, and conciseness. It may therefore be useful to bring together the general results of these experiments in a somewhat digested form, to serve as rules for practice. Other effects of calcareous manures will also be stated, which are equally established by experience, but which did not belong to any one accurately observed experiment.

The results that have been reported confirm in almost every particular the chemical powers before attributed to calcareous manures, by the theory of their action. It is admitted that causes and effects were not always proportioned—and that sometimes trivial apparent contradictions were presented. But this is inevitable, even with regard to the best established doctrines, and the most perfect processes in agriculture. There are many practices universally admitted to be beneficial; yet there are none, which are not found sometimes useless, or hurtful, on account of some other attendant circumstance, which was not expected, and perhaps not discovered. Every application of calcareous earth to soil is a chemical operation on a great scale. Decompositions and new combinations are produced, and in a manner generally conforming to the operator's expectations. But other and unknown agents may sometimes have a share in the process, and thus cause unlooked-for results. Such differences between practice and theory have sometimes occurred in my use of calcareous manures, (as may be observed in some of the reported experiments,) but they have neither been frequent, uniform, nor important.

But in nearly all such cases of disproportion between causes and effects, in the use of marl, the manner of variation has been in the effects surpassing the anticipated power of the causes, (as previously inferred from reasoning and in advance of my practice,) and in very few, if indeed any cases, of the contrary operation, of the results falling short of what might have been inferred from the theory of the action of calcareous manures. For such variation as this, it may be that no reader will require either excuse or explanation; nevertheless it is as much due to truth that it should be stated, as if the opposite kind of difference existed.

Before my earliest trials, or practical knowledge, of the effects of marl, I was well assured that this manure would correct the acidity of poor soil, and enable it to be enriched by putrescent manures. But I was still totally at a loss to know, or to guess, how much calcareous earth would be required for that result, or how much time might be required for the sufficient

quantity to produce its full effect; and there were grounds to fear that the quantity of the manure and time for its operation, and consequently the cost compared to profit, would be much greater than after-experience has shown. If 1000 bushels of ordinary marl had been required for an acre, and 10 years time for that application to raise the product to double its previous rate, the theory of the action of calcareous manures would have been sustained. But in fact, as great effect as this has been usually produced, (in judicious and proper practice,) by measures of marl and of time less by three-fourths than those just stated. And thus, while effects have almost universally exceeded in measure the supposed power of their causes, I may safely assert that in not a single case, in the tide-water region, of a judicious application of marl or lime, has it been known that the effect fell short of what would be indicated by my theory of the action of calcareous earth as manure.

But there is still another exception, if it be one, to admit, or of apparent want of accordance between theory and practice; and unluckily, this case is of the effects falling short of the supposed power of causes. There has as yet been made but little use of lime in the region immediately above the granite ridge which forms the lower falls of our eastern rivers. But almost all the failures of lime to act that have been heard of, or of effects falling much short of what were expected and are usual, are among the few experiments which have been made within fifty miles above the granite ridge. While truth requires that the fact of these failures should be stated, I pretend not to account for them. It may be the case, and probably is, that there is a general difference of chemical constitution between even lands of like apparent texture and qualities, above and below the falls. Of the lands above, my knowledge is but slight, and founded only on general and slight personal observation, or the report and better information of practical cultivators. But judging from such uncertain lights, I would infer that the lands above the falls were much less acid than those below, even when as poor. The growth of pine and of sorrel is more scarce on lands above the falls; and gypsum often acts there on natural soils, and lime (in some known trials) has produced but slight benefit. On the contrary, gypsum is scarcely ever operative on any natural soil below the falls, (that is on none of the great body of acid soil,) and lime never fails to act on these same lands.

The most important observation to be made on the disproportion of causes and effects, in the tide-water region, is in regard to good neutral soils, and especially as to that best class known by the common name of "mulatto land." On such soils, which constitute the chief value of the best farms of James river, the applications of lime have been the most extensive, and always highly effective.

The fact that the effects of calcareous manures so generally exceed in measure the supposed power of their causes, would seem to indicate that *some other kind of action of calcareous earth as manure operates*, in addition to all those set forth in chapter viii. This I think is more than probable.

Dismissing then from further consideration such exceptions (whether real or apparent) to general rules, I will return to stating the results of applying marl as they have occurred almost without exception in my own practice, and which are confirmed by the concurrence of all known and certain testimony in regard to practical operations in the marl region of Virginia.

Under like circumstances in other respects, the benefit derived from marling will be in proportion to the quantity of vegetable or other putrescent matter given to the soil. It is essential that the cultivation should be mild,

and that no grazing be permitted on poor lands under regular tillage, and which have no supply of putrescent manure, except the grass and weeds growing on them, while at rest. Wherever farm-yard manure is used, the land should be marled heavily, and if the marl is applied first, so much the better. The marl cannot act by fixing the other manure, except so far as they are in contact, and when both are well mixed with the soil.

When I first asserted the agency and force of calcareous manures in fixing alimentary manures in soils, and maintained the great and indispensable necessity of that operation, the proposition was founded almost exclusively on reasoning, and on observation of natural soils, and not at all on practical effects experienced from applications of marl or lime. From the very nature of the case, such effects as these, however important and valuable, could not be seen at first, nor fully even in a very few years after beginning to marl, nor their extent understood and appreciated. Moreover, my earlier experience had shown so fully the incapacity of my acid or naturally poor soils to retain alimentary manures, and my labors and expenditures to apply them had been so very unprofitable, that I was not myself prepared for the full extent of the contrary operation, after marl had been applied. And though the views and estimation of such new operation have been yearly enlarging, from the experience of practical results, yet even when the last edition of this work was published, my estimate of the *fixing* value of marl fell short of what is now confidently believed, and which is every season manifest, of the greater effect and permanency, and far greater profit of alimentary manures, caused solely by the presence of calcareous earth in the same soils. Notwithstanding that the theory of the action of calcareous manures, as set forth in this essay, and published as early as 1821, made this fixing operation the first of the two most important agencies, and though that theoretical view guided my practice from the beginning, still it was not until after a long time, that gradually and slowly I fully and truly estimated the value and profit of this operation. My early and zealous efforts (before beginning to marl) to improve naturally poor lands by the vegetable and animal manures of the farm, had been so much disappointed, and the effects had been so inconsiderable as well as so fleeting, that it was long before I arrived at the conviction of the full extent of the opposite and new condition of the soil. But during latter years, the certain and profitable operation, and durable operation, of every kind of vegetable or alimentary manure, no matter how or when applied, has been made obvious; and now my estimate of value would be, that if marling had no other operation whatever than this one of making other manures much more active and durable, the profit from this one source alone would amply reward all the usual labors and expenses of marling.

On "galled" spots, from which all the soil has been washed, and where no plant can live, the application of marl *alone* is utterly useless; at least, until time and accident shall furnish some addition of vegetable matter also. Putrescent manures alone would there have but little effect, unless in great quantity, and would soon be all lost. But marl and putrescent matter together serve to form a new soil, and thus both are brought into useful action; the marl is made active, and the putrescent manure permanent. The only perfect cures, that I have been able to make, at one operation, of galls produced upon a barren subsoil, were by applying a heavy dressing of both calcareous and putrescent manures together; and this method may be relied on as certainly effectual. But though a fertile soil may thus be created, and fixed durably on galls otherwise irreclaimable, the cost will generally exceed the value of the land recovered, from the great quantity of putrescent matter required. Much of our acid hilly land

has been deprived, by washing, of a considerable portion of its natural soil, though not yet made entirely barren. The foregoing remarks equally apply to this kind of land, to the extent that its soil has been carried off. It will be profitable to apply marl to such land; but its effect will be diminished, in proportion to the previous removal of the soil. Calcareous soils, from the difference of texture, are much less apt to wash than other kinds. Within a few years after marling a field that has been injured by washing, many of the old gulleys will begin to produce vegetation, and show that a soil is gradually forming from the dead vegetables brought there by winds and rains, although no means had been used to aid this operation.

This newly acquired ability to resist the washing power of rains, is one of the most beneficial effects of marling on hilly lands. And this effect is no less certain, than it is conformable to the theory of the action of marl and to reason. On soils containing very little lime, (or none, as in naked sub-soils,) whether they be sandy or clayey, there is nothing to combine the vegetable matter with the soil, nor the different ingredients of the soil with each other. Consequently they have no cohesion, and whenever made very soft, or semi-fluid by rains, and there is any declivity, there is nothing to prevent the soil, or upper surface, being washed off by excessive rain, though falling gently. Of course, torrents of rain produce the same injurious effects much more rapidly and effectually. But when such soils have been made calcareous, a chemical combination and bond of union and coherence is formed between the lime and the putrescent or organic matter, and of both with the silicious and argillaceous parts of the soil, which combination is able to resist any but an unusual degree of the washing action of rains. Moreover, by the increase of productive power thus given, grass grows more kindly and rapidly, and by its decay the vegetable mould is continually augmented, and thereby the power of resisting washing is still more increased as the fertility of the soil is increased. This is but another aspect and operation of the power of calcareous manure in soils to fix and retain manures.

The effect of marling will be much lessened by the soil being kept under exhausting cultivation. Such were the circumstances under which we may suppose that marl was tried and abandoned many years ago, in the case referred to in page 70. Proceeding upon the false supposition that marl was to enrich by direct action, like dung, it is most probable that it was applied to some of the poorest and most exhausted land, for the purpose of giving the manure a "fair trial." The disappointment of such ill-founded expectations was a sufficient reason for the experiment not being repeated, or being scarcely ever referred to again, unless as evidence of the worthlessness of marl. Yet with proper views of the action of this manure, this experiment might at first have as well proved the early efficacy and value of marl, as it now does its durability.

When acid soils are equally poor, the increase of the first crop from marling will be greater on sandy, than on clay soils; though the latter, by heavier dressings and longer time, may ultimately become the best land, at least for wheat and for grass. The more acid the growth of any soil is, or would be, if suffered to stand, the more increase of crop may be expected from marl; which is directly the reverse of the effects of putrescent manures. The increase of the first crop on worn acid soil, I have never known under fifty per cent., and more often it is as much as one hundred; and the improvement continues to increase, under mild tillage, to three or four times the original product of the land. [See Exp. 11, page 86, and Exp. 4 and 6.] In this, and other general statements of effects, I suppose the land to bear not more than two grain crops in four years, and not to

be subjected to grazing during the other two; and that a sufficient cover of marl has been laid on for use, and not enough to cause disease. It is true, that it is difficult, if not impossible, to fix that proper medium, varying as it may on every change of soil, of cropping, and of the kind of marl. But whatever error may be made in the proportion of marl applied, let it be on the side of light dressing, (except where putrescent manures are also laid on, or designed to be laid on before the next course of crops begins) —and if less increase of crop is gained to the acre, the cost and labor of marling will be lessened in a still greater proportion. If, when tillage has served to mix the marl well with the soil, sorrel should still show to any extent, it will sufficiently indicate that not enough marl had been applied, and that it may be added to, safely and profitably. If the nature of the soil, its condition and treatment, and the strength of the marl, all were known, it would be easy to direct the amount of a suitable dressing; but without knowing these circumstances, it will be safest to give not more than 200 or 250 bushels of marl, of say 40 per cent. to the acre of worn acid soils. Twice or thrice as much might be given, safely and profitably, to newly cleared wood land, or well manured land. Besides avoiding danger, it is more profitable to marl lightly at first on weak lands. If a farmer can carry out only ten thousand bushels of marl in a year, he will derive more product, and confer a greater amount of improvement, by spreading it over forty acres of the land intended for his next crop, than on twenty; though the increase to the acre would probably be greatest in the latter case. By the lighter dressing, the land of the whole farm will be marled, and be storing up vegetable matter for its progressive improvement, in half the time that it could be marled at double the rate.

The greater part of the calcareous earth applied at one time cannot begin to act as manure before several years have passed, owing to the coarse state of many of the shells, and the want of thoroughly mixing them with the soil. Therefore, if enough marl is applied to obtain its full effect on the first course of crops, there will certainly be too much afterwards.

Perhaps the greatest profit to be derived from marling, though not the most apparent in the first few years, is on such soils as are full of wasting vegetable matter. Here the effect is mostly preservative, and the benefit and profit may be great, even though the increase of crop may be very inconsiderable. Putrescent manure laid on any acid soil, or the natural vegetable cover of those newly cleared, without marl, would soon be lost, and the crops reduced to one-half or less. But when marl is previously applied, this waste of fertility is prevented; and the estimate of benefit should not only include the actual increase of crop caused by marling, but as much more as the amount of the diminution which would otherwise have followed. Every intended clearing of woodland, and especially of those under a second growth of pines, ought to be marled before cutting down; and it will be still better, if it can be done several years before. If the application is delayed until the new land is brought under cultivation, though much putrescent matter will be saved, still more must be wasted. By using marl some years before obtaining a crop from it, as many more successive growths of leaves will be converted to useful manure, and fixed in the soil; and the increased fertility will more than compensate for the delay. By such an operation, the farmer makes a loan to the soil, at a distant time for payment, but on ample security, and at a high rate of compound interest.

Some experienced cultivators have believed that the most profitable way to manage pine old fields, when cleared of their second growth, was to cultivate them every year, until worn out—because, as they said, such land

would not last much longer, no matter how mildly treated. This opinion, which would seem at first so absurd, and in opposition to all the received rules for good husbandry, is considerably supported by the properties which are here ascribed to such soils. When these lands are first cut down, an immense quantity of vegetable matter is accumulated on the surface, which, notwithstanding its accompanying acid quality, is capable of making two or three crops nearly as good as the land was ever before able to bring. But as the soil has no power to retain this vegetable matter, it will begin rapidly to decompose and waste, as soon as exposed to the sun; and will be lost, except so much as is caught, while escaping, by the roots of growing crops. The previous application of marl, however, would make it profitable in these, as well as other cases, to adopt a mild and meliorating course of tillage.

Less improvement will be obtained by marling worn soils of the kind called "free light land," than other acid soils which originally produced much more sparingly. The early productiveness of this kind of soil, and its rapid exhaustion by cultivation, at first view seem to contradict the opinion that durability and the ease of improving by putrescent manures are proportioned to the natural fertility of the soil. But a full consideration of the circumstances will show that no such contradiction exists.

In defining the term *natural fertility*, it was stated that it should not be measured by the earliest products of a new soil, which might be either much reduced, or increased, by temporary causes. The early fertility of free light land is so rapidly destroyed, as to take away all ground for considering it as fixed in, and belonging to the soil. It is like the effect of dung on the same land afterwards, which throws out all its benefit in the course of one or at most two years, and leaves the land as poor as before. But still it needs explanation why so much productiveness can at first be exerted by any acid soil, as in those described in the 14th experiment. The causes may be found in the following statement. These soils, and also their sub-soils, are principally composed of coarse sand, which makes them of more open texture than best suits pine, and (when rich enough) more favorable to other trees, the leaves of which have no natural acid, and therefore decompose more readily. As fast as the fallen leaves rot, they are of course exposed to waste; but the rains convey much of their finer parts down into the open soil, where the less degree of heat retards their final decomposition. Still this enriching matter is liable to be further decomposed, and to final waste; but though continually wasting, it is also continually added to by the rotting leaves above. The shelter of the upper coat of unrotted leaves, and the shade of the trees, cause the first as well as the last stages of decomposition to proceed slowly, and to favor the mechanical process of the products being mixed with the soil. But there is no chemical union of the vegetable matter with the soil. When the land is cleared, and opened by the plough, the decomposition of all the accumulated vegetable matter is hastened by the increased action of sun and air, and in a short time every thing is converted to food for plants. This abundant supply suffices to produce two or three fine crops. But now, the most fruitful source of vegetable matter has been cut off—and the soil is kept so heated (by its open texture) as to be unable to hold enriching matters, even if they were furnished. The land soon becomes poor, and must remain so, as long as these causes operate, even though cultivated under the mildest rotation. When the transient fertility of such a soil is gone, its acid qualities (which were before concealed in some measure by so much enriching matter,) become evident. Sorrel and broom grass cover the land, and if allowed to stand, pines will then take complete possession, because the poverty of the soil leaves them no rival to contend with.

Marling deepens cultivated sandy soils, even lower than the plough may have penetrated. This was an unexpected result, and when first observed seemed scarcely credible. But this effect also is a consequence of the power of calcareous earth to fix manures. As stated in the foregoing paragraph, the soluble and finely divided particles of rotted vegetable matters are carried by the rains below the soil; but as there is no calcareous earth there to fix them, they must again rise in a gaseous form, after their last decomposition, unless previously taken up by growing plants. But after the soil is marled, calcareous as well as putrescent matter is carried down by the rains as far as the soil is open enough for it to pass. This will always be as deep as the ploughing has been, and somewhat deeper in loose earth; and the chemical union formed between these different substances serves to fix both, and thus increases the depth of the soil. This effect is very different from the deepening of a soil by letting the plough run into the barren sub-soil. If, by this mechanical process, a soil of only three inches is increased to six, as much as it gains in depth, it loses in richness. But when a marled soil is deepened gradually, its dark color and apparent richness are increased, as well as its depth. Formerly, single-horse ploughs were used to break all my acid soils, and even these would often turn up sub-soil. The average depth of soil on old land did not exceed three inches, nor two on the newly cleared. Even before marling was commenced, my ploughing had generally sunk into the sub-soil—and since 1825, most of this originally thin soil has required three mules, or two good horses to a plough, to break the necessary depth. The soil is now from six to eight inches deep generally, from the joint operation of marling and deepening the ploughing a little in the beginning of every course of crops; and to that depth, or very nearly, the land is now ploughed whenever preparing for corn, or for wheat on clover.

Since marling was begun, the deepening of the soil has much more generally preceded than followed the deepening of the ploughing. How destructive to the power of soil this present depth of ploughing would have been, without marling, may be inferred from the continued decrease of the crop, through four successive courses of a very mild rotation, on the spot kept without marl in experiment 10. Yet the depth of ploughing there did not exceed six inches, and depths of nine and even twelve inches were tried, without injury, on parts of the adjacent marled land.

This remarkable and valuable effect of marling, in deepening the soil, is increased in action by the sub-soil being *sandy*, which is commonly deemed the worst kind of sub-soil. Land having a clay sub-soil, which is known in common parlance as land with "a good foundation," is almost universally prized; and that impervious sub-soil is supposed necessary to prevent the manure and the rains from sinking, and being lost. And such may be among the disadvantages, before marling, of poor land having a sandy sub-soil. But not so after marling. While the open texture of such a sub-soil permits so much of the water as is superfluous and injurious to sink and disappear, and the combined manures to sink enough to deepen the soil, (by converting barren sub-soil to productive soil,) the attractive force of the calcareous earth, for both putrescent matter and moisture, will much more effectually prevent either from being lost to the soil, than the mechanical obstruction of a clay sub-soil. Great as are the objections entertained by most farmers to sandy sub-soils, or to what they call "land without any foundation," I would decidedly prefer such to lands having an impervious clay sub-soil—supposing both to be equally barren. The subjects of all my experiments stated as made on acid sandy loams, had also sub-soils of yellow and barren sand; and on such lands have been made my greatest and most profitable improvements by marling. However, a sub-soil (and

also a soil) more of medium texture, would no doubt have been as much better than the very sandy, as the latter was better than the very stiff and impervious clay sub-soils.

Besides the general benefit which marling causes equally to all crops, by making the soils they grow on richer and more productive, there are other particular benefits which affect some plants more than others. For example, marling serves to make soils warmer, and thereby hastens the ripening of every crop, more than would take place on the like soils, if made equally productive by other than calcareous manures. This quality of marled land is highly important to cotton, as our summers are not long enough to mature the later pods. Wheat also derives especial benefit from the warmth thus added to the soil. It is enabled better to withstand the severe cold of winter; and even the short time by which its ripening is forwarded by marling, serves very much to lessen the danger of that crop from the worst of all its diseases, the *rust*. Wheat also profits by the absorbent power of marled land, (by which sands acquire, to some extent, the best qualities of clays,) though less so than clover and other grasses that flourish best in a moist climate. Indian corn does not need more time for maturing than our summers afford, (except on the poorest land,) and can sustain much drought without injury, and therefore is less aided by these qualities of marled land. Most (if not all) the different plants of the pea kind, and all the varieties of clover, derive such remarkable benefit from marling, that it must be caused by some peculiarity in the nature of those plants. Perhaps a large portion of calcareous earth is necessary as part of their food, to aid in the formation of the substance of these plants, as well as to preserve their healthy existence.

On acid soils, without heavy manuring, it is scarcely possible to raise red clover; and even with every aid from putrescent manure, the crop will be both uncertain and unprofitable. The recommendation of this grass, as part of a general system of cultivation and improvement, by the author of '*Arator*,' is sufficient to prove that his improvements were made on soils far better than such as are general. Almost every zealous cultivator and improver (in prospect) of acid soil has been induced to attempt clover culture, either by the recommendations of writers on this grass, or by the success witnessed on better constituted soils elsewhere. The utmost that has been gained, by any of these numerous efforts, has been sometimes to obtain one, or at most two mowings, of middling clover, on some very rich lot, which had been prepared in the most perfect manner by the previous cultivation of tobacco. Even in such situations, this degree of success could only be obtained by the concurrence of the most favorable seasons. Severe cold, and sudden alternations of temperature in winter and spring, and the spells of hot and dry weather which we usually have in summer, were alike fatal to the growth of clover, on so unfriendly a soil. The few examples of partial success never served to pay for the more frequent failures and losses; and a few years' trial would convince the most ardent, or the most obstinate advocate for the clover husbandry, that its introduction on the great body of land in lower Virginia was absolutely impossible. Still the general failure was by common consent attributed to any thing but the true cause. There was always some reason offered for each particular failure, sufficient to cause it, and but for which, (it was supposed,) a crop might have been raised. Either the young plants were killed by freezing soon after first springing from the seed—or a drought occurred when the crop was most exposed to the sun, by reaping the sheltering crop of wheat—or native and hardy weeds overran the crop—and all such disasters were supposed to be increased in force, and rendered generally fatal,

by our sandy soil, and hot and dry summers. But after the true evil, *the acid nature of the soil*, is removed by marling, clover ceases to be a feeble exotic. It is at once naturalized on our soil, and is able to contend with rival plants, and to undergo every severity and change of season, as safely as our crops of corn and wheat—and offers to our acceptance the fruition of those hopes of profit and improvement from clover, with which previously we had only been deluded.

After much waste of seed and labor, and years of disappointed efforts, I abandoned clover as utterly hopeless. But after marling the fields on which the raising of clover had been vainly attempted, there arose from its scattered and feeble remains, a growth which served to prove that its cultivation would then be safe and profitable. It has since been gradually extended over all the fields. It will stand well, and maintain a healthy growth on the poorest marled land; but the crop is too scanty for mowing, or perhaps for profit of any kind, on most poor sandy soils, unless aided by gypsum. Newly cleared lands yield better clover than the old, though the latter may produce as heavy grain crops. The remarkable crops of clover raised on very poor clay soils, after marling, have been already described. This grass, even without gypsum, and still more if aided by that manure, will add greatly to the improving power of marl; but it may do as much harm as service, if we greedily take from the soil nearly all of the supply of putrescent matter which it affords.

Some other plants, less welcome than clover, are equally favored by marling. Unless both the tillage and the rotation of crops be good, greensward (*poa pratensis*,) blue grass (*poa compressa*,) wire grass (*cynodon dactylon*,) and partridge pea (*vicia sativa*,) will soon increase so as to be not less impediments to bad tillage, or to the grain crops, than manifest evidences of an entire change in the character and power of the soil.

The power of calcareous manures is still more strongly shown in the eradication of certain plants, as has been before incidentally mentioned. Sorrel (*rumex acetosus*,) is the most plentiful and injurious weed on the cultivated acid soils of lower Virginia; an unmixed growth of poverty grass (*aristida gracilis* and *a. dichotoma*) is spread over all such lands, a year after being left at rest; at a somewhat later time broom-grass (*andropogon*) of different kinds covers them completely; and if suffered to remain unbroken a few years longer a thick growth of young pines will succeed. But as soon as such land is sufficiently and properly marled, there remains no longer the peculiar disposition or even power of the soil to produce these plants. Sorrel is totally removed, and poverty grass no more is to be found, where both in their turn before had entire possession. The appearance of a single tuft of either of these plants is enough to prove that the acid quality of the soil on that spot still remains, and that either more marl, or more complete intermixture, is still wanting. Thus, the presence of either of these plants is the most unerring as well as most convenient and ready indication of a soil wanting calcareous manure. The most laborious analyses, by the most able chemists, directed to ascertain the different characters of soils in this respect, are not to be compared for accuracy to the tests furnished by either the appearance or total absence of sorrel or poverty grass. In regard to broom-grass and pines, the change is not so sudden, nor complete; but still the soil will have been made manifestly unfriendly to both. Some striking apparent exceptions to these rules have caused some persons to doubt of their correctness; when full examination of the circumstances would have confirmed my positions. I have known a mere top-dressing of marl, left for some years on a worn-out old field, to eradicate the before general growth of broom-grass, and substitute

a cover of annual weeds. Yet on other tillage land, after marling and one crop of wheat on fallow, I have seen the growth of broom-grass return, and seemingly with greater than its former vigor. But this return and vigor were but temporary, and the land is now comparatively free from this injurious weed. When soil, already filled with its seeds, is very imperfectly mixed with marl by ploughing, these is nothing to prevent the broom-grass springing from all the spots not touched by the marl, whether these spots be above or below or between unmixed masses of marl. And the growth being thin and scattered, and not covering the surface completely as formerly, will cause the separate tufts of broom-grass to be much more luxuriant, and greater impediments to tillage, than previously. But the next course of tillage will serve to mix the marl and soil completely, and remove all appearance of marl being favorable instead of destructive to broom-grass. Sorrel may often be seen growing out of the heaps of pure marl, dropped from the carts on acid land, and the heaps left thus, unspread, through a summer. But this apparent and very striking exception may be fully explained. The heaps of marl, thus left, had not as yet by any intermixture affected the original composition of the soil below; and the seeds or roots of sorrel therein were therefore free to spring and grow; and the great hardiness and remarkable vital power of that plant enabled it to rise through the (to it) dead matter and great obstruction of several inches thickness of pure marl above. On examining the roots of sorrel thus growing out of marl, it will be seen clearly, and invariably, that they drew all their support from the still acid soil below, and merely passed through the marl, without drawing any thing therefrom.

CHAPTER XI.

RECAPITULATION OF EFFECTS, AND DIRECTIONS FOR PRACTICE CONTINUED.

Proposition 5—continued.

If the foregoing views may be confided in, the general course most proper to pursue in using calcareous manures may thence be deduced without difficulty. But as I have found, since the publication of the previous edition of this essay, that many persons still ask for more special directions to guide their operations, and as all such difficulties may not be entirely obviated even by the more full details now given, I will here add the following directions, at the risk of their being considered superfluous. These directions, like all the foregoing reasoning, may apply generally, if not entirely, to the use of all kinds of calcareous manures, and to soils in various regions; but to avoid too wide a range, I shall consider them as applied particularly to the poor lands of the tide-water region, and addressed to persons who are just commencing their improvement by means of the fossil shells or marl of the same region.

As the cheapest mode of furnishing vegetable matter to land intended to be marled and cultivated, no grazing should be permitted. It is best to put the marl on the grass previous to ploughing the field for corn, as the early effect of this manure is greatest when it has been placed in contact with the vegetable matter. But this advantage is not so great as to induce the ploughing to be delayed, or to stop the marling after that operation.

When the marl is spread upon the ploughed surface, it can be better mixed with the soil by the cultivation of the crop; and this advantage in some measure compensates for the loss of that which would have been obtained from an earlier application on the sod. If marl is ploughed in, it should not be so deeply as to prevent its being mixed with the soil, speedily and thoroughly, by the subsequent tillage. To make sure of equal operation, the marl should be spread regularly over the surface. From neglect in this respect, a dressing of marl is often too thin in many places to have its proper effect, and in others, so thick as to prove injurious. Hence it is, that marl-burnt stalks of corn and tufts of sorrel are sometimes seen on the same acre.

After the first year, the farmer may generally marl fast enough to keep ahead of his cultivation; and even though he should reduce the space of his tillage to one-half, it will be best for him not to put an acre in corn without its being marled. Fifty acres can generally be both marled and tilled, as cheaply as one hundred can be tilled without marling; and the fifty with marl will produce as much as the hundred without, in the first course of crops, and much more afterwards.

That rotation of crops which gives most vegetable matter to the soil, is best to aid the effects of marl recently applied. The four-shift rotation is convenient in this respect, because two or three years of rest may be given in each course of the rotation at first, upon the poorest land; and the number of exhausting crops may be increased, first to two, then to three in the rotation, as the soil advances to its highest state of productiveness.

After marling, clover should be sown, and gypsum on the clover. On poor, though marled land, of course only a poor growth of clover can be expected; but wherever other manures are given, and especially if gypsum is found to act well, the crop of clover becomes a most important part of the improvement by marling. Without clover, and without returning the greater part of the early product to the soil, the greatest value of marling will not be seen. A small proportion of the clover may be used as food for cattle; and in a few years even this small share will far exceed all the grass that the fields furnished before marling and the limitation of grazing. What is at first objected to as lessening the food of grazing stock, and their products, within a few years becomes the source of a far more abundant supply.

During the first few years of marling, but little attention can (or indeed ought to) be given to making putrescent manures, because the soil much more needs calcareous manure—and three or four acres may generally be supplied with the latter, as cheaply as one with the former. But putrescent manures cannot any where be used to so much advantage as upon poor soils made calcareous; and no farmer can make and apply vegetable matter as manure to greater profit than he who has marled his poor fields, and can then withdraw his labor from applying the more to the less valuable manure. After the farm has been marled over at the light rate recommended at first, every effort should be made to accumulate and apply vegetable manures; and with their gradual extension over the fields, a second application of marl may be made, making the whole quantity, in both the first and second marling, 500 or 600 bushels to the acre, or even more; which quantity would have been hurtful if given at first, but which will now be not only harmless, but necessary to fix and retain so much putrescent and nutritive matter in the soil.

The above injunction, that "every effort should be made to accumulate and apply vegetable manures," should not be limited, as most new improvers would be apt to do, to the mere economical use of the vegetable materials for manure furnished by the crops, and those only as prepared by being

first used as litter for animals. Not only these, but every other vegetable and putrescent material that is accessible should be saved and applied, and even without any intermediate process of preparation, and at any time of the year, and state of the fields, provided no growing or commencing crop be thereby molested. Surplus straw, not needed for food or litter, is most valuable and cheaply applied as top-dressing to clover or other grass; though it is an inconvenient and troublesome manure if immediately ploughed under. Leaves from the woods of the farm may be used most profitably in the same manner, to the full extent of the resources offered. And though the manuring operations on the Coggins Point farm have not yet been extended beyond the last named putrescent material, it is believed that other and abundant sources yet remain untried and unproductive on that and most other farms, and to use which would be but a waste of labor or money, if in advance of marling. Among the most abundant of such materials, may be mentioned marsh grasses and marsh or pond mud; and also the purchase of rich alimentary manures from towns, to be carried by land or by water carriage to much greater distances than has yet been done, or can be afforded to be done, on other lands. Even saw-dust and spent tanner's bark, which, because of their insolubility, are generally deemed of no value as manures, would form important and valuable materials for fertilization, in situations where they can be obtained cheaply and in great quantity. Mixing these or other insoluble vegetable substances with rich putrescent matters, and still more if with some alkaline matter also, would render them soluble, and convert them to food for plants.

But putting aside the consideration of all such unusual or untried resources and operations for additional fertilization, and limiting the present view merely to the ordinary materials furnished by every farm, the progress and profit of improvement by such means only, after marling, will be greater than will be at first believed by most cultivators of acid soils, not yet marled or limed. If, on such soils, the general course above advised be pursued, (and using merely the resources of the farm after marling,) the products of crops on all the marled land usually will be doubled in the first course of the rotation— often in the first crop immediately following the marling; and the original product may be expected to be tripled by the third return of the rotation. And this may be from merely applying marl in sufficient (and not excessive) quantities, and giving the land two years rest in four without grazing. But on the parts having the aid of farm-yard and other putrescent manures, and of clover, still greater returns may be obtained.

When such statements as these are made, the question naturally occurs to the reader, "Has the writer himself met with so much success, and what has been the actual result of his labors in general, in the business so strongly recommended?" This question I have no right to shrink from, although the answer to be given fully will be objectionable, from the egotism inseparable from such details, which are certainly not worth being thus presented to public notice, and which are called for only because silence on this head might be considered as operating against the general tenor of this essay. It will be sufficient here to state generally, that my average profits from marling, and the increased fertility derived from it, have not been as great as are promised above, nor such as might be expected from the most successful experiments of which the results have been reported— and for these reasons. 1st. The greater part of my land was not of soil the best adapted to be improved by marling. 2d. Having at first every thing to learn, and to prove by trial, much of my labor was lost uselessly, or spent in excessive and injurious applications. 3d. The fitness given to the soil by marl to produce clover was not found out until after that best

auxiliary to improvement ought to have been in full use. 4th. From the want of labor and capital to use both calcareous and putrescent manures, the collecting and applying of the latter were almost entirely neglected as long as there was full employment in marling. And, 5th. That general bad practical management, which I have to admit has marked all my business, has of course also affected injuriously this important branch—though in a less degree, because it was as much as possible (until about 1826,) under my personal and close attention. With all these drawbacks to complete success, I am able to state the following general results of my operations. Omitting the land on Coggins Point farm not susceptible of any considerable or profitable improvement from marling, the great body of the farm was tripled in productive power from 1818, when my first experiment was made, to 1834. Particular bodies of soil now produce four-fold the former amount without any other kind of manure; and the whole farm, including the parts least improved as well as the most, and allowing for the increase of extent of surface, will now make more than double of its best product before marling. Statements on this head, more in detail, will be given in the Appendix.

With all the increase of products that I have ascribed to marling, the heaviest amounts stated may appear inconsiderable to farmers who till soils more favored by nature. Corn yielding twenty-five or thirty bushels to the acre, is doubled by many natural soils in the western states; and ten or twelve bushels of wheat, will still less compare with the product of the best lime-stone clay land. The cultivators of our poor region, however, know that such products, without any future increase, would be a prodigious addition to their present gains. Still it is doubtful whether these rewards are sufficiently high to tempt many of my countrymen speedily to accept them. The opinions of many farmers have been so long fixed, and their habits are so uniform and unvarying, that it is difficult to excite them to adopt any new plan of improvement, except by promises of profits so great, that an uncommon share of credulity would be necessary to expect their fulfilment. The net profits of marling, if estimated at twenty or even fifty per cent. per annum, on the expense, for ever—or the assurance, by good evidence, of doubling the crops of a farm in ten years or less—will scarcely attract the attention of those who would embrace without any scrutiny, a plan that promised five times as much. Hall's scheme for cultivating corn was a stimulus exactly suited to their lethargic state; and that impudent Irish impostor found many steady old-fashioned farmers willing to pay for his directions for making five hundred barrels of corn without ploughing, and with the hand labor of two men only.

The products and profits derived from the use of marl as presented in the preceding pages, considerable as they are, have been kept down, or lessened in amount, by my then want of experience, and ignorance of the danger of injudicious applications. My errors may at least enable others to avoid similar losses, and thereby to reach equal profits with half the expense of time and labor. But are we to consider even the greatest known increase of product that has been yet gained in a few years after marling, as showing the full amount of improvement and profit to be derived? Certainly not; and if we may venture to leave the sure ground of practical experience, and look forward to what is promised by the theory of the operation of calcareous manures, we must anticipate future crops far exceeding what have yet been obtained. To this, the ready objection may be opposed, that the sandiness of the greater part of our lands will always prevent their being raised to a high state of productiveness—and particularly, that no care nor improvement can make heavy crops of wheat on such soils.

This very general opinion is far from being correct; and as the error is important, it may be useful to offer some evidence in support of the great value to which sandy soils may arrive.

We are so accustomed to find sandy soils poor, that it is difficult for us to connect with them the idea of fertility, and still less of durability. Yet British agriculturists, who were acquainted with clays and clay loams of as great value, and as well managed under tillage, as any in the world, speak in still higher terms of certain soils which are even more sandy than most of ours. For example—"Rich sandy soils, however," says Sir John Sinclair, "such as those of Frodsham in Cheshire, are invaluable. They are cultivated at a moderate expense; and at all times have a dry soundness, accompanied by moisture, which secures excellent crops, even in the driest summers."* Robert Brown (one of the very few who have deserved the character of being both able writers and successful practical cultivators) says—"Perhaps a true sandy loam, incumbent on a sound sub-soil, is the most valuable of all soils."† Arthur Young, when describing the soils of France, in his agricultural survey of that country, in several places speaks in the highest terms of different bodies of light or sandy soils, of which the following example, of the extensive district which he calls the plain of the Garonne, will be enough to quote: "It is entered about Creisensac, and improves all the way to Montauban and Toulouse, where it is one of the finest bodies of fertile soil that can any where be seen."—— "Through all this plain, wherever the soil is found excellent, it consists usually of a deep mellow friable sandy loam, with moisture sufficient for any thing; much of it is calcareous."‡ The soil of Belgium, so celebrated for its high improvement and remarkable productiveness, is mostly sandy. The author last quoted, in another work describes a body of land in the county of Norfolk, as "one of the finest tracts that is any where to be seen"——"a fine, deep, mellow, putrid sandy loam, adhesive enough to fear no drought, and friable enough to strain off superfluous moisture, so that all seasons suit it; from texture free to work, and from chemical qualities sure to produce in luxuriance whatever the industry of man commits to its friendly bosom."§ Mr. Coke, the great Norfolk farmer, made on the average 24 bushels of wheat to the acre, on an estate of as sandy soil as our Southampton, (where probably a general average of two bushels could not be obtained, if general wheat culture were attempted)—and many other farms in Norfolk yielded much better wheat than Mr. Coke's in 1804, when Young's survey was made. Several farms averaged 36 bushels, and one of 40 is stated; and the general average of the county was 24 bushels.‖ Yet the county of Norfolk was formerly pronounced by Charles II. to be only fit "to cut up into strips, to make roads of for the balance of the kingdom"—and that sportive description expressed strongly the sandy nature of the soil, as well as its then state of poverty.

Because certain qualities of poor clay soils (particularly their absorbent power) make them better than poor sands for producing wheat, we most strangely attach a value to the stiffness and intractability of the former. Yet if all the absorbent quality and productive power of clay could be given to sand, surely the latter would be the more valuable in proportion to its being friable and easy to cultivate. The causes of all the valuable qualities and productive power of the rich sands that have been referred to, are only calcareous and putrescent manures, and depth of soil; and if

* Code of Agriculture, p. 12.
† Brown's Treatise on Agriculture, p. 218, of "Agriculture" in Edin. Ency.
‡ Young's Tour in France.
§ Young's Survey of Norfolk, p. 4.
‖ Young's Survey of Norfolk, p. 300 to 304.

the same means can be used, our now poor sands may also be made as productive and valuable. I do not mean to assert that the most highly improved sandy soils can produce as much wheat as the best clay soils; but they will not fall so far short as to prevent their being the more valuable lands, for wheat as well as other crops, on account of their being more easily cultivated, and less liable to suffer from bad seasons, or bad management.

The greatest objection to the poor sandy lands of lower Virginia, as subjects for improvement by calcareous manures, is not their excess of sand, nor yet their poverty—great as may be both these disadvantages—but it is the *shallowness* of the poor and sandy soil. The natural soil of a large portion of these lands, before cultivation, is not more than from one to two inches deep, lying on a barren sub-soil of sand. Now suppose this very shallow soil to be doubled or even tripled in fertility by marling, or a productive power of 6 or 9 bushels of corn be raised to 18 bushels, still it would be but mean land. And a long succession of annual vegetable covers to be left on the land, or a great quantity of prepared putrescent manure furnished at once, would be required to make such soil both rich and deep. If the original soil had been ten inches deep, the fertility before marling might have been but little more than on the shallowest soil. But heavy marling and deep and good tillage would have served speedily to make a rich and productive soil, approaching in value to those rich sands of Europe mentioned above.

Another large class of the poor lands of lower Virginia are the close stiff clays, of which the soil is still more shallow than the sands. Such land was described at page 77 and formed the subjects of experiments 5, 6 and 7. This is the very worst soil known before being marled, and also the most worthless of all known marled soils. And yet a three-fold product has been usually obtained on these lands by marling alone, within four or at most eight years after the application of marl. Still, this land, as well as the most sandy, wants only greater depth of soil and abundance of vegetable matter, to become fertile and valuable.

While then calcareous manures may be counted on to produce great improvement on all soils not naturally provided with them—and to show as great a *per centage* of increase on the worst as on better soils, and a remunerating profit on all—still, it will be far more profitable to marl some soils than others. Dung, or other alimentary manure in the best condition for use, increases vegetation mainly in proportion to the quantity of the manure, and without regard or proportion to the previous product of the soil. Thus, a wasteful application of dung might in a single year increase the production of an acre of very poor land, from 5 bushels to 50 bushels of corn. But calcareous manures improve production in proportion to the previous power of the soil; and if the original product be very low, the addition thereto of 100 or even 200 per cent., made on the first crops after marling, will show still but a poor product. These remarks and illustrations are designed for the instruction of those beginners who deem it important to learn on what kinds of soil to apply their marl. In more general terms I would answer, "apply it to all soils not already calcareous;" for however different may be the measure of profit, I have never known marl applied unprofitably in regard to place, if applied judiciously in manner. Of course I refer to soils having some previous productive power and some tenacity; and not to such naked sands, drifting with the winds, as are seen in parts of North Carolina, South Carolina and Georgia.

CHAPTER XII.

THE PERMANENCY OF CALCAREOUS MANURES, AND OF ALIMENTARY OR PUTRESCENT MANURES, WHEN COMBINED WITH THE CALCAREOUS.

Proposition 5—continued.

It was stated, (page 70) that the ground on which an old experiment was made and abandoned as a failure, more than sixty years ago, still continues to show the effects of marl. Lord Kames mentions a fact of the continued beneficial effect of an application of calcareous manure, which was known to be one hundred and twenty years old.* Every author who has treated of manures of this nature, attests their long duration. But when they say that they will last twenty years, or even one hundred and twenty years, it amounts to the admission that at some future time the effects of these manures will be lost. This I deny—and from the nature and action of calcareous earth, claim for its effects a duration that will have no end.

If calcareous earth, applied as manure, is not afterwards combined with some acid in the soil, it must retain its first form, which is as indestructible, and as little liable to be wasted, by any cause whatever, as the sand and clay that form the other earthy ingredients of the soil. The only possible vent for its loss, is the very small proportion taken up by the roots of plants, which is so inconsiderable as scarcely to deserve naming.

Clay is a manure for sandy soils, serving to close their too open texture. When so applied, no one can doubt but that this effect of the clay will last as long as its presence, or as long as the soil itself. Neither can calcareous earth cease to exert its peculiar powers as a manure, any more than clay can, by the lapse of time, lose its power of making sands more firm and adhesive. Making due allowance for the minute quantity drawn up into growing plants, it is as absurd to assert that the calcareous earth in a soil, whether furnished by nature or not, can be exhausted, as that cultivation can deprive a soil of its sand or clay.

But on my supposition that calcareous earth will change its form by combining with acid in the soil, it may perhaps be doubted by some whether it will be equally safe from waste under its new form. It must be admitted that the permanency of this compound cannot be proved by its insolubility, or other properties, because neither the kind nor the nature of the salt itself is yet known.† But judging from the force with which good neutral soils resist the exhaustion of their fertility, and their always preserving their peculiar character, it cannot be believed that the calcareous earth, once present, has been lessened in durability by its chemical change of form. It was contended that the action of calcareous earth is absolutely necessary to make a poor acid soil fertile; but it does not thence follow that other substances, and particularly *this salt of lime*, may not serve as well to preserve the fertility bestowed at first by calcareous earth. All that is required for this purpose, is the power of combining with putrescent matter, and thereby fixing it in the soil; and judging solely from effects,

* Gentleman Farmer, page 266, 2d Edin. edition.

† This passage is left as it stood in the first edition, before the discovery of the humic acid was known. Indeed no aid has been derived from that discovery, nor any change of language made in consequence of it, except by inserting the quotation respecting this substance, and the remarks thereon, at page 53.

this power seems to be possessed in an eminent degree by this new combination of lime. If this salt is the oxalate of lime, (as there is most reason to believe,) it is insoluble in water, and consequently safe from waste; and the same property belongs to most other combinations of lime with vegetable acid. The acetate of lime is soluble in water, and while alone, might be carried off by rains. But if it combines with putrescent matter, by chemical affinity, its previous solubility will no longer remain. Sulphate of iron (copperas) is easily soluble; but when it forms one of the component parts of ink, it can no longer be separately dissolved by water, or taken away from the coloring matter combined with it. In rich limestone soils, and some of our best river lands, in which no carbonate of lime now remains, we may suppose that its change of form to some other salt of lime took place centuries ago. Yet, however scourged and exhausted by cultivation, these soils still show, as strongly as ever, the qualities which were derived from their former calcareous ingredient. When the dark color of such soils, their power of absorption, and of holding manures, their friability, and their peculiar fitness for clover and certain other plants, are no longer to be distinguished, then, and not before, may the salt of lime be considered as lost to the soil.

But though all persons would probably admit this general proposition, that these natural qualities of good soils, including a certain degree of, or tendency to productive power, are permanent, (which is but stating in other words, that the good effects of calcareous manures are permanent—) still perhaps few would grant the possibility of permanency of effect to putrescent manures also, when added thereafter. Yet this latter proposition is as legitimate a deduction from the former, as the former proposition is from the theory which has been maintained of the action of calcareous manures. The attention of the reader is requested to the argument which will now be offered to sustain this important deduction.

We have all been trained to consider farm-yard and stable manures, dung, and all vegetable and other putrescent matters, when applied to soils, as having temporary effects only; and whether the effects lasted for but the first crop, as on acid sandy soils, or for four, six or even eight years on well constituted natural soils, still the effects were truly, as usually considered, only for a limited time, and would at some period be totally lost, and the ground so manured would return to the same state of less productiveness, as of the surrounding land, previously equal, and which had received no such manuring. Such views are almost universal; and the utmost that would be claimed by the most zealous and sanguine advocate for extending the use of such manures, would be a protracted though still limited and temporary duration of effect. And the actual results would always accord with these opinions, (and also with my theory of the action of calcareous manures,) both on good and on bad soils, before making them more calcareous. All natural soils (not excessively and injuriously calcareous,) have secured by their natural powers and facilities, and have had fixed in them, as much alimentary matter as their natural ingredient of lime could combine with. If that ingredient had been very small, the soil would be poor; if large, then the soil would be rich. But in neither case would there be power in the soil to combine with an additional supply of alimentary manure; and if such were applied, it would be exhausted and pass away, rapidly on the bad soil, and more slowly on the good; but certainly, in the end, on both.

Again, suppose the soils to be more or less exhausted by scourging cultivation. Then their actual amount of alimentary matter would have been reduced below what their respective shares of lime could combine with

and retain, under a state of nature, or of mild tillage. Then, if alimentary manures were applied, so much as was required for combination by the lime present would be as permanently fixed as if the original fertility had never been abstracted; and any additional quantity and excess of manure, not being so combined and fixed, would be totally lost in more or less time, as in the previously supposed case.

Lest these propositions may not appear, because of their novelty, perfectly clear and unquestionable to every reader, an illustration will be offered which can scarcely fail to induce their general and ready admission. Suppose a cultivator to have two fields, one of bad and poor soil naturally, and the other of the best natural quality—and both having been brought under cultivation together, and kept under the same rotation of crops and other management. Suppose further that the equal and uniform course of cropping has been such, (whether taking one or two or three grains crops to one year of rest and resuscitation,) that both fields have neither been reduced nor increased in average product, since brought under regular tillage—and that such average product, when of corn, is equal to 10 bushels per acre on the poor, and 50 bushels on the rich soil. Now, these different products are derived from the different funds of alimentary and putrescent manure originally supplied to the soil by nature, (which were just so much as the lime of each soil could combine with,) and, under the supposed degrees of exaction and relief counteracting each other under tillage, the same rates of product may be obtained for ever. And the yielding of 50 bushels by the one soil operates no more to reduce its after power of production, than the yield of the other of but one-fifth of that amount of crop. The yield from each soil, at and for the time, is certainly so much reduction of its productive power; but the recuperative power of each (to seize upon and hold to new supplies for fertilization) is in proportion to the yield; and the vegetable growth serving for manure, and atmospherical influences, during a year of rest, will continually give to the good soil the renewed power of producing again its large crop, as certainly as to the poor soil the power of still continuing to produce its small crop. It is not that the natural alimentary manure in the soil is not taken away in part, by the growth and removal of every crop—but that such waste is continually compensated by new acquisitions. And whether such new supplies of alimentary matter be furnished in part during every day, or in every year, or only during the one term of rest in the whole course of crops, the practical result is the same, of the natural or original amount of alimentary manure remaining finally undiminished.

So far as to the absolute permanency of putrescent or alimentary manures supplied by nature. Next let us see whether the same reasoning, and also experience, so far as yet obtained, do not in like manner prove the permanency of putrescent manures applied after calcareous manures. The poor soil just presented for illustration, while having its natural alimentary ingredient and its natural supply of lime thus balanced and proportioned to each other, was supposed to produce at the rate of 10 bushels of corn to the acre, and to remain at or near that rate of productive power. Suppose then marl to be applied in such quantity as would give enough calcareous earth to combine with twice as much new alimentary matter as the soil before held. Suppose further, that the soil so marled is not left to draw and store up this now needed stock of alimentary manure by its newly increased power, (and as would be done in due time, if under favorable circumstances of tillage,) but that so much putrescent manure is applied to the soil, gradually and judiciously, as can be combined with and held by the supply of calcareous earth; and that such addition of manure gives to

the soil a power to produce 30 bushels of corn. As soon as this combination is completely made, the soil is in precisely the same condition as to its newly increased rate of product of 30 bushels, as before to that of 10 bushels; and the new and larger supply of putrescent manure must be as permanent as was the natural and smaller supply.

But it is not contended that the mere application of vegetable or other putrescent manure, under such circumstances, secures the permanency of effect of all thus applied, but only of so much as can be and is combined with the calcareous earth. And many circumstances may and do usually obstruct the immediate and complete combination taking place. To ensure the perfect and full result, the intermixture of the calcareous and the putrescent matters, and in due proportions, must be perfect, and no excess of the latter remain any where in the soil; the putrescent matter must also be in the particular state of decomposition (whatever that may be) to enter into combination; and moreover there must be enough and equally diffused moisture, without which no chemical combination can take place. Now as some and probably all these conditions must necessarily be deficient in every case of applying putrescent matters to marled land, it must follow that much of the manure must remain uncombined for some length of time; and during that time is as liable to be wasted and exhausted as if in any other soil. And hence, and the more as the dressing is lavish, farmyard and stable manure so applied must be expected to yield more for the first and second year, while the excess is wasting, than afterwards. But after this first waste and exhaustion has been suffered, whatever of the manure remains to the soils, say for the next ensuing rotation at latest, must be fully combined with and fixed in the soil, and will be permanent for all future time, under proper, judicious, and also the most profitable course of cropping. This first waste probably cannot be entirely prevented; but can be much lessened by care. And to this end, putrescent manure should not be applied heavily at once, but lightly, and repeated subsequently, and should be well scattered and equally diffused over the ground. Its subsequent decomposition being slow, and the products being gradually as well as surely presented to the lime diffused previously throughout the soil, will also tend to remove as much as possible of the manure from the condition of being fleeting and wasting, to that of being fixed and permanent.

Next let us see how far facts and experience sustain this reasoning. It is readily admitted that the time since marling was commenced in Virginia, and since correct views of the action of calcareous manures were entertained and acted on in any case, has been too short to furnish decided proofs. But so far as accurate facts can thus be referred to, they fully sustain the foregoing doctrine, not only of the permanency of calcareous manures, but also of putrescent manures in combination therewith. Some of these facts will be mentioned generally.

However in accordance with the theory of the action of calcareous manures, this absolute permanency of effect given thereby to putrescent manures was not at first counted on or expected, and was not known until it was forced on my observation by long continued results. My own practice is not only the oldest, but is all that I can refer to for proofs. And until all my marling was completed, and indeed for some time after, but little care was used by me to make and apply putrescent manures. This culpable neglect was the result of the habits caused by the disappointments and losses experienced in manuring long before. From the same ignorance and carelessness in this respect, no experiments on the durability of putrescent manures were made until long after, and then injudiciously.

Thus, in the three experiments 4, 9, and 11, the putrescent manure applied was in quantity much too great for the calcareous earth to combine with at once, even if the recent and irregular scattering of both kinds of manure had not prevented their meeting in proper proportions. For like reasons, of all the putrescent manures applied on the farm, and since larger quantities have been used, there is much more of *early* than *continued* effect. Still, so far as known and believed, there is always more or less of abiding effect, and which I infer will be permanent.

But wider scope for observation has been afforded in the increasing productiveness of all the marled lands, kept under what was deemed not too frequent tillage. Neither has the tillage been always mild, nor the rotation uniform, and latterly the grain crops have been made more frequent than before, and much more grazing permitted. Still, even where no prepared putrescent manures have ever been applied, and putrescent matters have been furnished only from the growth of the land itself during its share of rest in each course of crops, there has been a regular increase of productiveness of the grain crops, in every successive rotation. In one connected clearing, of what I found as poor forest land, now making 85 acres, the marling was commenced in 1818, and has been continued, as the successive clearings extended, to 1841. The earliest effects of the applications were always satisfactory, but they have regularly and largely increased with time. Thus, when under the last crop of corn, (in 1839,) the crop on the last finished marling, though perhaps thereby nearly doubled in product, was obviously and considerably less than that of four to six years earlier—that again as inferior to that of the marling of ten to fifteen years—and the crop on the marling of 1821 and earlier, decidedly the best of all, under circumstances otherwise equal. For the limited time of 23 years, and without any careful and accurate experiment or observation having been made for this special object, there could not well be stronger practical proof of the permanency of the vegetable manures stored up by the marl.

If we keep in mind the mode by which calcareous manure acts, its effects may be anticipated for a much longer time than my experience extends. Let us trace the supposed effects, from the causes, on an acid soil kept under meliorating culture. As soon as applied, the calcareous earth combines with all the acid then present, and to that extent is changed to the *vegetable salt of lime.* The remaining calcareous earth continues to take up the after formations of acid, and (together with the salt so produced) to fix putrescent manures, as fast as these substances are presented, until all the lime has been combined with acid, and all their product is combined with putrescent matter. Both those actions then cease. During all the time necessary for those changes, the soil has been regularly increasing in productiveness; and it may be supposed that before their completion, the product had risen from ten to thirty bushels of corn to the acre. The soil has then become neutral. It can never lose its ability (under the mild rotation supposed) of producing thirty bushels—but it has no power to rise above that product. Vegetable food continues to form, but is mostly wasted, because the salt of lime is already combined with as much as it can act on; and whatever excess of vegetable matter remains in the soil, is kept useless by acid also newly formed, and left free and noxious as before the application of calcareous earth. But though this excess of acid may balance and keep useless the excess of vegetable matter, it cannot affect the previously fixed fertility, nor lessen the power of the soil to yield its then maximum product of thirty bushels. In this state of things, sorrel may again begin to grow, and its return may be taken as notice that a new marling is needed, and will afford additional profit, in the

same manner as before, by destroying the last formed acid, and fixing the last supply of vegetable matter. Thus perhaps five or ten bushels more may be added to the previous product, and a power given to the soil gradually to increase as much more, before it will stop again for similar reasons, at a second maximum product of forty or fifty bushels. I pretend not to fix the time necessary for the completion of one or more of these gradual changes; but as the termination of each, and the consequent additional marling, will add new profits, it ought to be desired by the farmer, instead of his wishing that his first labor of marling each acre may also be the last required. Every permanent addition of five bushels of corn, to the previous average crop, will more than repay the heaviest expenses that have yet been encountered in marling. But whether a second application of marl is made or not, I cannot imagine such a consequence, under judicious tillage, as the actual decrease of the product once obtained. My earliest marled land has been severely cropped, compared to the rotation supposed above, and yet has continued to improve, though at a slow rate. The part first marled, in 1818, had only four years of rest in the next fifteen; and yielded nine crops of grain, one of cotton, and one year clover twice mowed. This piece, however, besides being sown with gypsum, (with little benefit,) once received a light cover of rotted corn-stalk manure. The balance of the same piece of land (Exp. 1) was marled for the crop of 1821—has borne the same treatment since, and has had no other manure, except gypseous earth once, (in 1830,) which acted well. These periods of twelve and fifteen years (even though now extended to and confirmed by nine years more of experience) are very short to serve as grounds to decide on the eternal duration of a manure. But it can scarcely be believed that the effect of any temporary manure, would not have been somewhat abated by such a course of severe tillage. Under milder treatment, there can be no doubt that there would have been much greater improvement.

If subjected to a long course of the most severe cultivation, a soil could not be deprived of its calcareous ingredient, whether natural or artificial; but though still calcareous, it would be, in the end, reduced to barrenness, by the exhaustion of its vegetable matter. Under the usual system of exhausting cultivation, marl certainly improves the product of acid soils, and may continue to add to the previous amount of crop, for a considerable time; yet the theory of its action instructs us, that the ultimate result of marling, under such circumstances, must be the more complete destruction of the land, by enabling it to yield all its vegetable food to growing plants, which would have been prevented by the continuance of its former acid state. An acid soil yielding only five bushels of corn may contain enough food for plants to bring fifteen bushels—and its production will be raised to that mark, as soon as marling sets free its dormant powers. But a calcareous soil reduced to a product of five bushels, can furnish food for no more, and nothing but an expensive application of putrescent manures, can render it worth the labor of cultivation. Thus it is, that soils, the improvement of which is the most hopeless without calcareous manures, will be the most certainly improved with profit by their use.

CHAPTER XIII.

THE EXPENSE AND PROFIT OF MARLING.

Proposition 5—concluded.

At this time there are but few persons among us who doubt the great benefit to be derived from the use of marl: and many of those who ten years ago deemed the practice the result of folly, and a fit subject for ridicule, now give that manure credit for virtues which it certainly does not possess; and from their manner of applying it seem to believe it a universal cure for sterility.* Such erroneous views have been a principal cause of the many injudicious and even injurious applications of marl. It is as necessary to moderate the ill-founded expectations which many entertain, as to excite the too feeble hopes of others.

The improvement caused by marling, and its permanency, have been established beyond question. Still the improvement may be paid for too dearly—and the propriety of the practice must depend entirely on the amount of its clear profits, ascertained by fair estimates of the expenses incurred.

With those who attempt any calculations of this kind, it is very common to set out on the mistaken ground that the expense of marling should bear some proportion to the selling price of the land: and without in the least under-rating the effects of marl, they conclude that the improvement cannot justify an expense of six dollars on an acre of land that would not previously sell for four dollars. Such a conclusion would be correct if the land were held as an article for sale, and intended to be disposed of as soon as possible: as the expense in that case might not be returned in immediate profit, and certainly would not be added to the price of the land by the purchaser, under present circumstances. But if the land is held as a possession of any permanency, its previous price, or its subsequent valuation, has no bearing whatever on the amount which it may be profitable to expend for its improvement. Land that sells at four dollars, is often too dear at as many cents, because its product will not pay the expense of cultivation. But if by laying out for the improvement ten dollars, or even one hundred dollars to the acre, the average increased annual profit would certainly and permanently be worth ten per cent. on that cost of improvement, then the expenditure would be highly expedient and profitable. We are so generally influenced by a rage for extending our domain, that another farm is often bought, stocked and cultivated, when a liberal estimate of its expected products, would not show an annual clear profit of three per cent.: and any one would mortgage his estate to buy another thousand acres, that was supposed fully capable of yielding ten per cent. on its price. Yet the advantage would be precisely the same, if the principal money was used to enrich the land already in possession, (without regard to its extent, or previous value,) with equal assurance of its yielding the same amount of profit.

Nothing is more general, or has had a worse influence on the state of agriculture, than the desire to extend our cultivation and landed possessions. One of the consequences of this disposition has been to give an artificial value to the poorest land, considered merely as so much territory,

* This was in 1831, when these remarks were first printed. They are less applicable now than formerly.

while various causes have concurred to depress the price of all good soils much below their real worth. Whatever a farm will sell for fixes its value as merchandise; but by no means is it a fair measure of its value as permanent farming capital.

The true value of land, and also of any permanent improvements to land, I would estimate in the following manner. Ascertain as nearly as possible the average clear and permanent annual income, and the land is worth as much money as would securely yield that amount of income, in the form of interest—which may be considered as worth six per cent. For example, if a field brings ten dollars average value of crops to the acre, in the course of a four-shift rotation, and the average expense of every kind necessary to carry on the cultivation is also ten dollars, then the land yields nothing, and is worth nothing. If the average clear profit was but two dollars and forty cents in the term, or only sixty cents a year, it would raise the value of the land to ten dollars; and if six dollars could be made annually, clear of all expense, it is equally certain that one hundred dollars would be the fair value of the acre. Yet if lands of precisely these rates of profit were offered for sale at this time, the poorest would probably sell for four dollars, and the richest for less than thirty dollars. In like manner, if any field, that paid the expense of cultivation before, has its average annual net product increased six dollars for each acre, by some permanent improvement, the value thereby added to the field is one hundred dollars the acre, without regard to its former worth. Let the cost and value of marling be compared by this rule, and it will be found that the capital laid out in that mode of improvement will seldom return an annual interest of less than twenty per cent.—that it will more often reach to forty—and sometimes exceed one hundred per cent. of annual and permanent interest on the investment. The application of this rule for the valuation of such improvements will raise them to such an amount, that the magnitude of the sum may be deemed a sufficient contradiction of my estimates. But before this mode of estimating values is rejected, merely for the supposed absurdity of an acid soil being considered as raised from one dollar, or nothing, to thirty dollars, or more, per acre, by a single marling, let it at least be examined and its fallacy exposed.

If the reader will accompany me through some detailed estimates of values, and arithmetical calculations, in regard to the grounds of which we cannot differ, the truth of the result which I claim will be made manifest, however startling and monstrous they may appear to some persons at first glance.

Assuming as sound and unquestionable the grounds for estimating the intrinsic value of lands, as stated generally in the last paragraph, let us illustrate the position more particularly. The principle of valuation is that the land is worth to its proprietor and cultivator such sum of money as would yield in annual interest the same amount as the net annual product of the land, after paying for all labor, attention, expenses and risks. Further, to simplify the calculation, and also to suit the course of culture to the more general practice of the country, let us suppose the land in question to be cultivated under the ordinary three-shift rotation, of 1st, corn, 2nd, wheat, (or oats,) 3rd, at rest, with no grazing when the land is poor, and with but partial and moderate grazing (or mowing of clover) when improved or rich.

Then suppose a field of the poor and thin soil most common in lower Virginia, under this treatment for some years previously, to produce, on the general average, 10 bushels of corn to the acre, and 5 bushels of wheat, or its equivalent value of oats; and the value of the corn, at the barn, to be 50 cents the bushel, and of the wheat $1. And let the joint and total

expenses of preparation, tillage, seed, harvesting, thrashing, &c., for market, (or for home use,) and of superintendence and care of both the corn and wheat or oat crops, be counted as being over and above the value of the offal (stalks, straw, &c.) of the crops, by $10 for the two years. Then the full statement will be as follows:

First year, product in corn per acre, 10 bushels, at 50 cents -	$5
Second year, wheat, 5 bushels, at $1, - - - - - - -	5
Third year, no crop or profit, and no expense, - - - -	0
Total product of the three-years' rotation, - - - -	$10
Cost of cultivation, &c., of the crop, - - - - -	10
Net profit, - - - - - - - - - - - -	00

However wretched may be the foregoing exhibition of products, it will be admitted to be abundantly liberal by all persons acquainted with lower and middle Virginia, for a very large proportion of the cultivated lands. Yet such lands might sell at prices varying from $3 to $6 the acre, and that without a view to their being improved, and even before calcareous manures were thought of as means for improvement. Yet the conclusion is evident, that such land, no matter what may be its then selling price, (or speculative appreciation caused by the effects of paper-money and fraudulent bank issues,) is worth not one cent for cultivation, or for the benefit of the proprietor and cultivator.

Next, suppose the land in question to be properly marled, and at the unusually heavy expense of $7 the acre. This rate is more than double the usual expense for a full and sufficient dressing, when the marl is obtained on the farm where applied. Suppose also that the increase of products, as shown in the second course of the rotation, (beginning three years after the application,) is equal to 100 per cent. on the production previous to marling. This estimate is quite low enough, as all experience has shown. Upon such land, and so treated, this degree of increase may very often be obtained upon the first crop of the first course; and, even if no auxiliary means of enriching be afterwards used, the rate of increase will be more and more for each of sundry succeeding courses of crops thereafter. Then let us test the value of the returns by figures as before:

First year, product in corn per acre, 20 bushels, at 50 cents, -	$10
Second year, wheat, 10 bushels, at $1, - - - - - -	10
Third year, clover most of it left as manure to the land, and no profit counted here, - - - - - - - - -	00
	20
Total expenses of cultivation, &c., as before, in two years, -	10
Net product, or clear profit of cultivation in the term of three years, - - - - - - - - - - - -	$10

This is all so much *increase of net annual product* upon the previous rate; and the amount, $3.33 yearly, is the interest, (at 6 per cent.,) of something more than a capital of $55. And therefore, according to these grounds of estimate, $55 per acre is the *increase of intrinsic value* given to the land by marling alone, or $48 the *clear gain* made by the operation, after deducting $7 paid for the marling of the land; and this without regard to what might have been its previous intrinsic value, or its former or its present market price. The more rigidly this mode of estimate is scrutinized, the more manifestly true will be found the results. The premises assumed, in the supposed effects and profits of marling, will not be objected to

(unless as being too low) by any person who is well informed by practice and experience.

But there is one important apparent omission of a proper charge in the last statement of expenses. This is the *increase of labor* of tillage, harvesting, &c., caused by the crop being doubled in quantity. This is certainly a fair ground of charge; and, if estimated alone, would serve to reduce considerably the statement of increased net product, and consequently of increased value of land. But there were also omitted sundry items of increased production, which together would undoubtedly much more than compensate for the increase of labor in tilling a deeper and richer soil, and in harvesting, removing and preparing for sale or use, a double quantity of crop. These items of gain are, first, the additional offal, in corn-stalks, fodder and shucks, and wheat or oat straw, and chaff—second, the limited proportion of clover grazed or mowed—and third, the further gradual increase of crops, in subsequent time. Probably the first class of items alone would balance the increased expense of labor; if not, the addition of the second (the clover) certainly would be enough. And if that be doubted, the subsequent annual increase upon the first doubling of the crops (which only is estimated above) will not only furnish a fund to meet any such deficiency, but also will greatly, and beyond any calculation here attempted, augment the whole profit of marling, and consequently the intrinsic value of the land to the proprietor.

I admit the practical difficulty of applying this rule for estimating the value of land, or of its improvement, however certain may be its theoretical truth. It is not possible to fix on the precise clear profit of any farm to its owner and cultivator; and any error made in these premises is increased sixteen and two-third times in the estimate of value founded on them. Still we may approximate the truth with most certainty by using this guide. The early increase of crop from marling will, in most cases, be an equal increase of clear profit, (for the subsequent improvement and the additional offal will surely pay for the increase of labor—) and it is not very difficult to fix a value for that actual increase of crop, and thereby to estimate the value of the improvement, as farming capital.*

This mode of valuing land, under a different form, is universally received as correct in England. Cultivation there is carried on almost entirely by tenants; and the annual rent which any farm brings, on a long lease, fixes beyond question what is its annual clear profit to the owner. The price, or value of land, is generally estimated at so many "years' purchase," which means as many years' rent as will return the purchaser's money. There, the interest of money being lower, increases the value of land according to this mode of estimation; and it is generally sold as high as twenty years' purchase. My estimate is less favorable for raising the value of our lands, as it fixes them at sixteen and two-thirds years' purchase, according to our higher rate of interest on money.

But though this rule for estimating the true value of land, and of the improvements made by marling, may be unquestionable in theory, still a practical objection will be presented by the well known fact that the income and profits of farmers are not increased in proportion to such improvements, nor is there found such a vast disproportion as this rule of estimating values would show, between the profits of the tillers of poor and of rich lands. These positions are admitted to be generally well founded—but it is denied that they invalidate the previous estimates. A farmer may,

* No degree of uncertainty in the application, however, detracts from its truth. For if the annual average net profit derived from marling be considered as an *unknown quantity* (x), it is not therefore the less certain that $x \times 16\frac{2}{3} =$ the increased intrinsic value of the land.

and generally does, obtain less gross product from a large or a rich farm, than his more necessitous, and therefore more attentive and economical neighbor gets from a smaller or poorer farm, in proportion to the producing power of each; and even the same persons, when young and needy, have often made more profit according to their means, than afterwards when relieved from want, and having lands increased to a double power of production. These, and similar facts, however general, are only examples of the obvious truth, that the profits of land depend principally on the industry, economy, and good management of the cultivator; and that many a farmer, who can manage well a small or poor farm, is more deficient in industry, economy, or the increased degree of knowledge required, when possessed of much more abundant resources. In short, if these considerations were to direct or influence our estimates, we should not be comparing and estimating the value of lands, but the value of the care and industry bestowed on their management by their proprietors.

Another objector may ask, "If any poor land is raised in value, (according to this estimate,) from one dollar to thirty, by marling, would a purchaser make a judicious investment of his capital, by buying this improved land at thirty dollars?" I would answer in the affirmative, if the view was confined to this particular means of investing farming capital. The purchaser would get a clear interest of six per cent.—which is always a good return from land, and is twice as much as all lower Virginia now yields. But if such a purchase is compared with other means of acquiring land so improved, it would be extremely injudicious; because thirty dollars expended in purchasing and marling suitable land, would serve both to acquire and improve, to as high a value, five or six acres.

Estimates of the expenses required for marling are commonly erected on as improper grounds as those of its profits. We never calculate the cost of any old practice. We are content to clear wood-land that afterwards will not pay for the expense of tillage—to keep under the plough land reduced to five bushels of corn to the acre—to build and continue to repair miles of useless and perishable fences—to make farm-yard manure, (though not much of this fault,) and apply it to acid soils—without once calculating whether we lose or gain by any of these operations. But let any new practice be proposed, and then every one begins to count its cost; and that on such erroneous premises, that if applied to every kind of farm labor, the estimate would prove that the most fertile land known could scarcely defray the expenses of its cultivation.

According to estimates made with much care and accuracy, the cost of an uncommonly expensive job of marling, 4036 bushels in quantity, in 1824, amounted to $5.35 the acre, for 598 bushels of marl. This quantity was much too great; 400 bushels would have been quite enough for safety and profit, and would have reduced the whole expense, including every necessary preparation, to $3.50 the acre. The earth which was taken off, to uncover the bed of marl, was considerably thicker than the marl itself. The road from the pit ascended hills amounting to fifty feet of perpendicular elevation—and the average distance to the field was 847 yards. The full estimates of these operations will be presented in the next chapter.

It is impossible to carry on marling to advantage, or with any thing like economy, unless it is made a regular business, to be continued throughout the year or a specified portion of it, by a laboring force devoted to that purpose, and not allowed to be withdrawn for any other. Instead of proceeding on this plan, most persons, who have begun to marl, attempt it in the short intervals of leisure afforded between their different farming operations—and without lessening for this purpose the extent of their usual

cultivation. Let us suppose that the preparations have been made, and, on the first opportunity, a farmer commences marling with zeal and spirit. But every new labor is attended by causes of difficulty and delay, and a full share of these will be found in the first few days of marling. The road is soft, for want of previous use, and, if the least wet, soon becomes miry. The horses, unaccustomed to carting, balk at the hills, or only carry half loads. Other difficulties occur from the awkwardness of the laborers and the inexperience of their master, and still more from the usual unwillingness of his overseer to devote any labor to improvements which are not expected to add to the crop of that year. Before matters can get straight, the leisure time is at an end; and the work is stopped, and the road and pit are left to get out of order, before making another attempt, some six months after, when all the same vexatious difficulties are again to be encountered.

If only a single horse is employed in drawing marl throughout the year, at the moderate allowance of two hundred working days, and one hundred bushels carried out for each, his year's work will amount to twenty thousand bushels, or enough for more than sixty acres. This alone would be a great object effected. But, besides, this plan would allow the profitable employment of any amount of additional labor. When, at any time, other teams and laborers could be spared to assist, though for only a few days, every thing is ready for them to go immediately to work. The pit is drained, the road is firm, and the field marked off for the loads. In this way much labor may be obtained in the course of the year, from teams that would otherwise be idle, and laborers whose other employments would be of but little importance. The spreading of marl on the field is a job that will always be ready to employ any spare labor; and throwing off the covering earth from an intended digging of marl may be done when rain, snow, or severe cold has rendered the earth unfit for almost every other kind of labor.

Another interesting question respecting the expense of this improvement is, to what distance from the pit may marl be profitably carried? If the amount of labor necessary to carry it half a mile is known, it is easy to calculate how much more will be required for two or three miles. The cost of teams and drivers is in proportion to the distance travelled, but the pit and field labors are not affected by that circumstance. At present, when so much poor land, abundantly supplied with fossil shells, may be bought at from two dollars to four dollars the acre, a farmer had better buy and marl a new farm, than to move marl even two miles to his land in possession.* But this would be merely declining one considerable profit, for the purpose of taking another much greater. Whenever the value of marl shall be properly understood, and our lands are priced according to their improvement, or their capability of being improved from that source, as must be the case hereafter, then this choice of advantages will no longer be offered. Then rich marl will be profitably carted miles from the pits, and

* This statement of prices, though correct when first published, is no longer so. Some little land may yet be so low; but, in general, the prices of lands having marl have already advanced from 50 to 100 per cent. within 15 years. The lowest of the above named prices was much above the former minimum rate. The various tracts of land in James City county belonging to Mrs. Paradise's large estate, when sold some 12 or 14 years ago, brought prices that averaged only about $1.25 the acre. Most of the lands were poor, but easily improvable, and all having plenty of rich marl. One of the tracts of that description, of 800 acres, was bought at 75 cents the acre; and after being held for three or four years, without being in any respect improved, was resold by the purchaser for $2.50 the acre. Where marl has been actually applied, the increased intrinsic or productive value of the land always considerably exceeds the increased market price, even though the latter may be already doubled or tripled.

perhaps conveyed by water as far as it may be needed. A bushel of such marl as the bed on James river, described page 92, is as rich in calcareous earth alone, as a bushel of slaked lime will be after it becomes carbonated, and the greater weight of the first is a less disadvantage for water carriage, than the price of the latter. Farmers on James river, who have used lime as manure to great extent and advantage, might more cheaply have moved rich marl twenty miles by water, as it would cost nothing but the labor of digging and transportation.

Within the short time that has elapsed since the first publication of the foregoing passages in the first edition of this essay, the transportation of marl by water carriage has been commenced on James river, and has been carried on with more facility and at less expense than was anticipated. The farmers who may profit by this new mode of using marl will be indebted to the enterprise of C. H. Minge, esq., of Charles City, for having made the first full and satisfactory experiment of the business on a large scale.

Since the publication of the last edition, the transportation of marl by water-carriage has been carried on much more extensively. But very recently another source for obtaining calcareous manures has been opened to the farmers of lower Virginia, which they think cheaper than either transporting marl or burning shells, and they are availing of it to great extent. This is northern stone-lime, which is brought in bulk, ready slaked, and sold by the vessel load at prices varying from 8 to 10 cents the bushel. Slaked lime, even if pure, from its extreme lightness, cannot be as much to the bushel as rich marl contains of pure lime, even though the marl may have 30 per cent. of other earths. Therefore the lime is much the most costly, as marl may be procured and transported at from 3 to 5 cents the bushel. Still, the lime is so much more readily obtained in large quantities, and a farm can by that means be so much more speedily covered, that the purchase of lime is often the more desirable and also the more profitable operation of the two.

In making this improvement, more than in any other business, "time is money." Marling is usually effected by the farmer's labor, whereas the expense of liming is mostly in the purchase. By the use of water-borne marl, few farmers could dress a fourth of their tillage field in a year, whereas by purchasing lime the whole field might be limed, and the whole farm covered in one-fourth of the time required for marling. If then the lime were even thrice the cost of marl, (for equal quantities of pure lime,) it would still be the cheapest mode of improvement, because yielding its products in one-fourth of the time required for marling. The difference of amount of net product in the first crop, between an acre marled or limed, and another acre not so improved, would usually pay the cost of marling or liming the acre. Therefore, on every acre cultivated by any farmer, and not marled or limed until *after* making the crop, there is as much loss of crop suffered by the delay, as would have paid for making the improvement.

The objections to carrying marl unusual distances, admitted above, apply merely to improvements proposed for field culture. But it would be profitable, even under existing circumstances, for rich marl to be carried five miles by land, or one hundred miles by water, for the purpose of being applied to gardens, or other land kept under perpetual tillage, and receiving frequent and heavy coverings of putrescent manure. In such cases, independent of the direct benefit which the calcareous earth might afford to the crops, its power of combining with putrescent matters, and preventing their waste, would be of the utmost importance. If the soil

is acid, the making it calcareous will enable half the usual supplies of manure to be more effective and durable than the whole had been. There are other uses for marl, about dwelling houses and in towns, which should induce its being carried much farther than mere agricultural purposes would warrant. I allude to the use of calcareous earth in preserving putrescent matters, and thereby promoting cleanliness and health. This important subject will hereafter be separately considered.

Either lime or good marl may hereafter be profitably distributed over a remote strip of poor land, by means of the rail-road now constructing from Petersburg to the Roanoke [1831]; provided the proprietors do not imitate the over greedy policy of the legislature of Virginia in imposing tolls on manures passing through the James river canal. If there were no object whatever in view but to draw the greatest possible income from tolls on canals and roads, true policy would direct that all manures should pass from town to country toll free. Every bushel of lime, marl, or gypsum thus conveyed, would be the means of bringing back, in future time, more than as much wheat or corn; and there would be an actual gain in tolls, besides the twenty-fold greater increase to the wealth of individuals and the state. Wood-ashes, after being deprived of their potash, have calcareous earth, and a smaller proportion of phosphate of lime, as their only fertilizing ingredients; and both together do not commonly make more than there is of calcareous earth in the same bulk of good marl. Yet drawn ashes have been purchased largely from our soap factories, at five cents the bushel, and carried by sea to be sold for manure to the farmers of Long Island. Except for the proportion of phosphate of lime which they contain, drawn ashes are simply artificial marl—more fit for immediate action, by being finely divided, but weaker in amount of calcareous earth than our best beds of fossil shells.

The argument in support of the several propositions which have been discussed through so many chapters, is now concluded. However unskilfully, I flatter myself that it has been effectually used; and that the general deficiency in our soils of calcareous earth, the necessity of supplying it, the profit by that means to be derived, and the high importance of all these considerations, have been established too firmly to be shaken by either arguments or facts.

CHAPTER XIV.

ESTIMATES OF THE COST OF LABOR APPLIED TO MARLING.

Before we can estimate with any truth the expense of improving land by marling, it is necessary to fix the fair cost of every kind of labor necessary for the purpose, and for a length of time not less than one year. We very often hear *guesses* of how much a day's labor of a man, a horse, or a wagon and team, may be worth—and all are wide of the truth, because they are made on wrong premises, or no premises whatever. The only correct method is to reduce every kind of labor to its elements—and to fix the cost of every particular necessary to furnish it. This I shall attempt; and if my estimates are erroneous in any particular, other persons better informed may easily correct my calculation in that respect, and make the necessary allowance on the final amount. Thus, even my mistakes in

the grounds of these estimates, will not prevent true and valuable results being derived from them.

The following estimates were made in 1828, according to the prices of that year. I shall make no alteration in any of the sums, because there is no considerable difference at this time, (January 1832,) and the least alteration would make it necessary to change the after calculations founded on them. But no one estimate will suit for years of different prices. If any one desires to know the value of labor when corn (for example) is higher or lower, he must ascertain the difference in that item, and add or deduct, so as to correct the error.

Cost of the labor of a negro man in 1828.

Hire for the year, payable at the end, - - - - -			$38 00
Food—19½ bushels of corn at 40 cents,	7 80		
Add 10 per cent. for waste in keeping,	78		
Meat and fish, &c.	9 00		
		$17 58	
Interest for one year on $17 58, paid for food,		1 05	
			18 63
Clothing—6 yards coarse woollen cloth, at 50 cents,		3 00	
12 yards cotton, for summer clothes and two shirts, at 12 cents,		1 44	
Blanket at $1 50, once in two years—yearly,		75	
Shoes and mending,		2 50	
			7 19
Taxes—State, 47 cents—county 47—poor 33—road, suppose 1 dollar,		2 27	
His share of expense of quarters, fuel, and sending to mill,		4 50	
Nursing when sick, (exclusive of medical aid,)		1 50	
			8 27
			$72 09
Add 20 per cent. on the whole of the above for cost of superintendence, waste, wanton damage to stock, tools, &c.. and thefts,			14 41
Total expense per year,			$86 50

Time lost—Sundays and holidays, 58 days
Bad weather and half holidays, suppose 20
Sickness, suppose 10
Making in all 88

From 365, deduct 88, leaves 277 working days; which makes the cost of each working day 31¼ cents.

The hire was fixed at the average price obtained that year for ten or twelve young men hired out at the highest bids, for field labor. According to the established custom, all the expenses of medical attendance, and loss of time from the death of a slave occurring when he is hired, are paid, or deducted from the hire by the owner, and therefore are omitted in this estimate. By supposing the slave to be hired by his employer, instead of being owned, the calculation is made more simple, and therefore more correct.

Cost of the labor of a negro woman.

Hire for the year,	$12 00
Food,	12 95
Clothing, blanket, and shoes,	6 50
Taxes, quarters, fuel, mill, nursing, &c.	7 19
Add 20 per cent. as before, for superintendence, &c.,	7 73
Total yearly cost,	$46 37

Suppose lost time, 100 days, leaves working days 265, at 17½ cents for each.

Nearly all the women who are usually hired out are wanted by persons having few or no other slaves, as cooks, or for some other employment at which they are more useful than at field labor—and their price is nearer fifteen dollars in these cases. But when there is no demand for such purposes, women for field labor will not bring more than twelve dollars.

A boy of twelve or thirteen would hire for more than the foregoing estimate of the hire of a woman, but would not lose half the time from sickness and bad weather, and therefore may be supposed to cost the same per day, or seventeen and a third cents. A girl of fourteen or fifteen years, for similar reasons, may be put at the same price.

Cost of the labor of a horse.

First cost of a good work horse, $80 00—supposed to last five years at work, makes the yearly *wear*,	$16 00	
Interest for one year on $80 00—$4 80—tax, 12 cents,	4 92	
		$20 92
20 bbls. of corn at $2 00—3,500 lbs. of fodder at 50 cents the hundred,	$57 50	
Add 10 per cent. for waste in keeping,	5 75	
		63 25
Interest on $63 25, for one year,	$3 79	
Share of yearly expense for corn-house,	47	
		4 26
Total yearly cost,		$88 43

Lost time, 98 days, leaves 267 working days, at 33 cents nearly.

A mule eats less corn than a horse, but more hay, and lives longer, and may be considered as costing one-fifth less, or yearly cost, $70 00, and daily, 26½ cents.

A tumbrel for marling, will cost when new, $25 00	
It will last two years, or (what is the same thing) if that sum will pay for all repairs, for two years, its wear per year, is	$12 50
Interest on $25 00 for a year,	1 50
Cost per year,	$14 00

And at 267 working days—cost per day five cents.

In the estimate of the cost of horse labor, no charge is made for attendance, because that is part of the labor of the driver, and forms part of *his* expense. No charge is made for grazing, because enough corn and hay

are allowed for every day in the year— and when grass is part of his food, more than as much in value is saved in his dry food. No charge is made for stable or litter, as the manure made is supposed to compensate those expenses.

It may be supposed that the prices fixed for corn, and fodder or hay, are too low for an average. Such is not my opinion. The price is fixed at the beginning of the year, when it is always comparatively low, because it is too soon for purchasers to keep shelled corn in bulk, and the market is glutted. Besides, the allowance for waste during the year's use (10 per cent.) makes the actual price equal to two dollars and twenty cents on July 1st. The nominal country price of corn in January is almost always on credit—and small debts for corn are the latest and worst paid of all. The farmer who can consume any additional portion of his crop, in employing profitable labor, becomes his own best customer. The corn supposed to be used, by these estimates, is transferred on the first of January, without even the trouble of shelling or measuring, from A. B. *corn-seller*, to A. B. *marler*, and instantly paid for. Two dollars per barrel at that early time, and obtained with as little trouble, from any purchaser, would be a better regular sale than the average of prices and payments have afforded for the last eight years.

Cost of marling, founded on the foregoing estimates of the cost of labor.

From the beginning of November, 1823, to the 31st of May, 1824, a regular force, of two horses and suitable hands, was employed in marling on Coggins Point, on every working day, unless prevented by bad weather, wet and soft roads, or some pressing labor of other kinds. The same two horses were used, without any change, and indeed they had drawn the greater part of all the marl carried out on the farm, since 1818. The best of the two was seventeen years old—both of middle size, and both worse than any of my other horses, which were kept at ploughing.

The following estimates were made on a connected portion of this time and labor, and upon my own personal observation and notes of the work, from the beginning to the end. It was very desirable to me to know the exact cost of some considerable job of marling, attended with certain known difficulties, and on any particular mode of estimating the expense; for although the same degree of difficulty, and of cost of labor, might never again be met with, still, any such estimate would furnish a tolerable rule to apply, in a modified form, to any other undertaking of this kind. These estimates may be even more useful to other persons; as they will serve generally to prove that the greatest obstacles to the execution of this improvement are less alarming, and more easily overcome, than any inexperienced persons would suppose.

Both these jobs were attended with uncommon difficulties, in the unusual thickness of the superincumbent earth, compared to that of the fossil shells worth digging, and on account of the distance, and amount of ascent, to the field. The first job was so much more expensive than was anticipated, that it may perhaps be considered as a failure— but as the account of its expense had been kept so carefully, it will be given just as if more success and profit had been obtained. This work was commenced April 14th, 1824. The bed of marl for the upper six feet of its thickness is dry and firm, though easy to dig, and rich. It has an average strength of 45 per cent., the shells mostly pulverized, and the remaining earth more of clay than sand. After being carried out, the heaps appear, to a superficial observer, to be a coarse loose sand. Below six feet, the marl became so

poor as not to be worth carrying out, and was not used except when the distance was very short. Its strength was less than 20 per cent. The bed at first was exposed on the surface, near the bottom of a steep hill-side; but as a large quantity had been taken out, and several successive cuts made into the face of the hill some years before, the covering earth was increased on the space now to be cleared, so as to vary between eight and sixteen feet, and I think averaged between eleven and twelve. The situation of the marl and road required that a clear cart-way should be made as low as the intended digging; and therefore nearly all of the earth was to be moved by a scraper, and was thrown into the narrow bottom at the foot of the hill. This earth served thus to form an excellent causeway across the valley, which made part of the road in the next undertaking. All this marl runs horizontally, and the layers of different qualities are very uniform in their thickness. The greater part of the covering earth is a hard clay, or impure fuller's earth, which was difficult to dig, and still more so for the scraper to take up and remove. Part was thrown off by shovels, and served to increase a mound made by former operations, within the circle around which the scraper was drawn.

Labor used in digging and removing earth.

4 days' labor of	9 men, at 31¼ cents each, - - - -	$11 25
4	6 women, at 17½ cents, - - - -	5 55
4	2 boys, at 17½ cents, - - - -	
4	1 young girl at 15, and 1 old man at 25,	1 60
4	8 oxen, (the scraper being drawn by 4 half the day, which then rested and grazed while the others worked the other half of the day,) at 15 cents each, - - - -	4 80
Add 80 cents for wear of scraper, hoes, and shovels, - - -		80
Total, - - - - - - - - - - -		$24 00

The price allowed for the oxen is much too high for the common work, and so much rest allowed; but they work so seldom at the scraper, that both the men and the oxen are awkward, and the labor is very heavy, and even injurious to the team.

Labor of digging and carrying out the marl.

Three tumbrels were kept at work on this job and the next, a good mule being added to the regular carting force—and no time was lost from April 20th to May 31st, except when carts broke down, (which was very often, owing to careless driving, and worse carpentry,) or when bad weather compelled this labor to stop. One man dug the marl and assisted to load; another man loaded, and led the cart out of the pit, until he met another driver returning from the field, to whom he delivered the loaded cart and returned to the pit with the empty one. Of the two other drivers, one was a boy of sixteen, and the other twelve years old—the youngest only was permitted to ride back, when returning empty. The distance to the nearest part of the work (measured by the *chain*) was nine hundred and two yards, and to the farthest one thousand and forty-five; adding two-thirds of the difference to the nearest for the average distance, makes nine hundred and ninety-seven yards. The ascent from the pit, by a road formerly cut

and well graduated for marling, was supposed to be twenty-five feet in perpendicular height; and every trip of the carts, going and coming, crossed a valley supposed to be fifteen feet deep, and both sides forming a hill-side of that elevation.

When only four and a half feet of the marl had been dug, a large mass of earth fell into the pit, covered entirely the remaining one foot and a half of marl, and stopped all passage for carts. To clear away this obstruction would have cost more labor than the remaining marl was worth, and therefore this pit was abandoned. This happened on May 10th, when six hundred and ninety-nine loads had been carried out, and the work done was equal to thirty-six days' work of one cart, (by adding together all the working time of each,) which was nineteen and a half loads for the average daily work of each cart, or fifty-eight for the three. The average size of the loads, by trial, was five and a half heaped bushels; and the weight, one hundred and one pounds the bushel. It was laid on at one hundred and four loads, or five hundred and seventy-two bushels the acre.

Labor employed for 699 *loads, or* 3844 *bushels.*

2 men at 31¼ cents,	62½	
2 boys at 19 cents,	38	
2 horses at 33 cents,	66	
1 mule at 26½ cents,	26½	
3 carts at 5 cents,	15	
Tools at 3 cents,	3	
Daily expense, or for 58 loads,	$2 11	
Digging and carting 699 loads at the same rate,		$25 43
Add the total expense of removing earth,		24 00
		$49 43
Spreading at 50 cents the 100 loads,		3 50
Total expense,		$52 93

Which makes the cost per bushel, 1 25-100 cents.
per load, (5½) 7
per acre, of 572 bushels, $7 85

This marl was laid on much too thick for common poor land, and one fourth of the body uncovered was lost by the falling in of the earth. If one fourth of the expense of uncovering the marl was deducted on account of this loss, it would reduce the whole expense nearly one eighth.

As soon as the carts were stopped in the work just described, they were employed in moving earth from similar marl, across the ravine. The thickness, strength, and other qualities of the marl, on both sides, are not perceptibly different. A large quantity had also been formerly dug on this side, but the land being lower, the covering earth was not more than ten feet where thickest, and the average was eight and a half or nine feet. To make room for convenient working, and a large job, an unusual space was cleared, ten to fourteen feet wide, and perhaps fifty or more long. The shape of the adjoining old pits compelled this to be irregular. The greater

part of the earth was of the same hard fuller's earth mentioned as being on the other side—and the upper part of this was still worse, being in woods, and the digging obstructed by the roots and trees.

Labor used in digging and removing the earth.

6 men	5 days, at	31¼ cents,	$9	37½
5 women 1 woman 2 boys	5 1 5	at 17½ cents,	6	24
1 old man	2	25 cents,		50
2 girls	6	15 cents,	1	80
8 oxen, for the scraper as before, each team at rest half the day, 5 days, at 15 cents,			6	00
3 horses and carts, 1½ days, at 38 cents,			1	71
Add for damages to scraper and other utensils,				86¼
Total cost of moving earth,			$27	48¾

Enough of the earth was carried by the carts to the dam crossing the ravine, to raise the road as high as the bottom of the intended pit. The balance was thrown into the valley wherever most convenient. Only a small proportion, perhaps one third, could be thrown off, without being carried away by the carts and scraper.

The loads were carried to the same field, and by the same road as from the former digging. The first hundred and ninety-one loads served to finish the piece begun before, of which the average distance was nine hundred and ninety-seven yards; all the balance was carried to land adjoining the former, eight hundred and forty-seven measured yards from the pit.

The loads were ordered to be increased to six bushels, which was as much as the carts (without tail-boards) could hold, without waste in ascending the hills; but as the loaders often fell below that quantity, I suppose the average to have been five and three fourths heaped bushels, or five hundred and eighty-one pounds.

The tumbrels were kept constantly at this work, except when some of the land was too wet, or for some other unavoidable cause of delay. All the space which the old pits occupied, and over which the road passed, being composed of tough clay thrown from later openings, and which had never become solid, was made miry by every heavy rain, and caused more loss of time than would usually occur at that season. The same four laborers, and two horses and one mule, employed as before, and their daily work was as follows:

May 13th, began the new pit
13th, 2 carts all the day, and 1 for 2 hours only, (afterwards otherwise employed,) - - - - - 47 loads.
14th, 2 " half the day, then employed otherwise—(1 horse idle) - - - - - - - - - 21
15th, 3 " - - - - - - - - - 61
16th, Sunday.
17th, 3 " finished most distant work with - - - 62
—— 191

Average distance 997 yds.

Brought forward, - - - - - - - - -	loads 191	
And the same day began nearest work with - -	- 4	Average distance 847 yards.
May 18th, 3 carts for 4 hours (stopped by heavy rain,)	- 22	
19th and 20th, 3 carts at work elsewhere, on drier land.		
21st, 3 " again marling, - - - - - -	- 75	
22d, rain, no work done by horses.		
23d, Sunday.		
24th, 1 " at other work.		
25th, 3 " again marling, - - - - -	- 74	
26th, 3 " - - - - - - - - -	- 75	
27th, 3 " - - - - - - - - -	- 72	
28th, 3 " - - - - - - - - -	- 72	
29th, 3 " (shafts of one broken and repaired,) -	- 64	
30th, Sunday.		
31st, 3 " until rain at 4 P. M. - - - -	- 53	
	511	
	702	

After this stoppage, the horses were put to ploughing the corn, that the cultivation might be sufficiently advanced to use all the laborers in harvest, which began on the 11th of June. As near as I could determine by inspection, and a rough cubic measurement, about one half of the uncovered marl was then dug and carried out. As the remainder was not dug until August, when I was absent from home, I have no more correct means of ascertaining these proportions; and shall according to this supposition charge *half* the actual cost of the whole uncovering of earth, to this supposed half of the marl which formed this last operation.

The list of days' work shows that the average number of loads per day, at eight hundred and forty-seven yards, was twenty-four and a half for each cart, which made twenty-three and a half miles for the day's journey of each horse. The first four days' work finished the farthest piece, of which the average distance was nine hundred and ninety-seven yards—but this part of the work was on the nearest side of that piece, and at less than that average distance. I shall not make any separate calculation, for these hundred and ninety-one loads, but consider all as if carried only eight hundred and forty-seven yards.

The daily cost of the laboring force, 2 men, 2 boys, 2 horses, and 1 mule, was before estimated at $2 11—which served to carry out 73½ loads, or 422 bushels. At that rate, (to May 31st,) 702 loads, or 4036 bushels, cost, - - - - -	$20 15
Add half the expense of uncovering, (half the marl still remaining not dug,) - - - - - - - - -	13 74
For spreading, at 31¼ cents per hundred loads, - - -	2 18¾
Total cost of 4036 bushels laid on, - - -	$36 07¾

Which makes the cost per bushel, 9 mills nearly.

And per acre, at 104 loads, or 598 bushels. - - - -	$5 34½
Or, at 400 bushels, which would have been a sufficient, and much safer dressing, per acre, - - - - - - -	$3 57½

In 1828, at Shellbanks, Prince George county, a very poor, worn, and hilly farm, I commenced marling, and in about four months finished 120½ acres at rates between 230 and 280 bushels per acre. The time taken up in this work was five days in January, and all February and March, with

two carts at work—and from the 5th of August to the 27th of September, with a much stronger force. I kept a very minute journal of all these operations, showing the amount of labor employed, and of loads carried out during the whole time. It would be entirely unnecessary to state here any thing more than the general amounts of labor and its expense, after the two particular statements just submitted. At Shellbanks, the difficulties of opening pits were generally less, the average distance shorter, and the reduced state of the soil, and the strength of the marl, made heavy dressings dangerous. These circumstances all served to diminish the expense to the acre. The difficulties, however, at some of the pits, were very great, owing to the quantity of water continually running in, through the loose fragments of the shells; and almost every load was carried up some high hill. Taking every thing into consideration, I should suppose that the labor and cost of this large job of marling will be equal to, if not greater than the average of all that may be undertaken, and judiciously executed, on farms having plenty of this means for improvement, at convenient distances. The whole cost of this large job was as follows:

Preparatory work, including uncovering marl, cutting and repairing the necessary roads, and bringing corn (from another farm) for the teams—digging, carrying out, and spreading 6892 loads of marl, (4½ heaped bushels only, because of the steep hills, and sometimes wet marl,) on 120½ acres, -	$258 38
At the average rate of 57½ loads, or 259 bushels per acre, the average expense was, to the acre, - - - - - -	2 08
To the load, - - - - 3 cents and 63-100ths,	
And to the bushel, - - - 0 83-100ths.	

When the preceding edition of this essay was published, (in 1835,) the transportation of marl by water had been but recently commenced. Since, the business has been greatly increased. But still it is badly conducted in general, and therefore is much more costly than it would be under better and proper direction. Farmers are averse to being engaged in the management of vessels, or any other business away from their farms, and therefore they have always preferred to buy the marl from vessels, even at higher prices, rather than to have it dug by their own laborers and transported in their own vessels. And this division of labor would be right in all respects if the owners of the river lighters were better managers of their business, and their hands were industrious and sober. For rich marl thus obtained and transported, the prices at the purchasers' landings have usually been from 4 to 5 cents the heaped bushel. And at these high prices, the lazy and worthless and illy provided navigators have rarely realized any profit. The highest price charged for marl, in beds on the river banks, is a half cent the bushel. Under existing circumstances, the cheapest and best mode of obtaining water-borne marl is for the farmer to also carry on the digging and the navigating. And if the several operations were properly conducted, the entire expense of water-borne marl, say 10 to 30 miles, will rarely exceed three cents the bushel when landed, and under favorable circumstances may fall short of two cents. Collier H. Minge, Esq., of Charles City, and Dr. Corbin Braxton, of King William county, who have carried on this business extensively, and for years in succession, for marling their own farms, have furnished me with careful and detailed estimates of their expenses, which have been published at length in the Farmers' Register, (p. 567 vol. i. and p. 691, vol. viii.) According to the estimate of Mr. Minge, the entire cost of thus procuring marl, carried 15 miles on the broad water of James river, amounted to less than two cents the heaped bushel, when landed. And

Dr. Braxton's total expense, the transportation being for eight miles on the narrow and smooth Pamunkey, was but little more than half a cent the bushel, placed at his landing. No charge was made for the marl in either case, but every other charge or expense was included. The labor and difficulties on James river, both of uncovering and digging the marl (at Coggins Point) and unloading (on a shallow creek) were unusually great; and on the Pamunkey these labors were very light. A vessel and also a mode of loading, safe in strong winds, were necessary on James river; while no such danger had to be feared, or was guarded against, on the well sheltered Pamunkey river. So much of the business in both these cases, as was conducted from home, necessarily was wanting of proper superintendence; and, no doubt, both of these undertakings suffered for that important deficiency, as in all cases where labor is on a small scale of operations, and more especially when slave labor is employed.

CHAPTER XV.

THE USE OF CALCAREOUS EARTH RECOMMENDED TO PRESERVE PUTRESCENT MANURES, AND TO PROMOTE CLEANLINESS AND HEALTH.

The operation of calcareous earth in enriching barren soils has been traced, in a former part of this essay, to the chemical power possessed by that earth of combining with putrescent matters, or with the products of their fermentation—and in that manner preserving them from waste, for the use of the soil, and for the food of growing plants. That power was exemplified by the details of an experiment, (page 60,) in which the carcass of an animal was so acted on, and its enriching properties secured. That trial of the putrefaction of animal matter in contact with calcareous earth, was commenced with a view to results very different from those which were obtained. Darwin says that *nitrous acid* is produced in the process of fermentation, and he supposes the *nitrate of lime* to be very serviceable to vegetation.* As the nitrous acid is a gas, it must pass off into the air, under ordinary circumstances, as fast as it is formed, and be entirely lost. But as it is strongly attracted by lime, it was supposed that a cover of calcareous earth would arrest it, and form a new combination, which, if not precisely nitrate of lime, would at least be composed of the same elements, though in different proportions. To ascertain whether any such combination had taken place, when the manure was used, a handful of the marl was taken, which had been in immediate contact with the carcass, and thrown into a glass of hot water. After remaining half an hour, the fluid was poured off, filtered, and evaporated, and left a considerable proportion of a white soluble salt, (supposed eight or ten grains.) I could not ascertain its kind—but it was not deliquescent, and therefore could not have been the nitrate of lime. The spot on which the carcass lay was so strongly impregnated by this salt, that it remained bare of vegetation for several years, and until the field was ploughed up for cultivation.

But whatever were the products of fermentation saved by this experiment, the absence of all offensive effluvia throughout the process sufficiently proved that little or nothing was lost, as every atom must be, when flesh putrefies in the open air; and I presume that a cover of equal thickness of clay, or sand, or any mixture of both, without calcareous earth,

* Darwin's Phytologia, pp. 210 and 224. Dublin edition.

would have had very little effect in arresting and retaining the aeriform products of putrefaction. All the circumstances of this experiment, and particularly the good effect exhibited by the manure when put to use, prove the propriety of extending a similar practice. In the neighborhood of towns, or wherever else the carcasses of animals, or any other animal substances subject to rapid and wasteful putrefaction, can be obtained in great quantity, all their enriching powers might be secured, by depositing them between layers of marl, or calcareous earth in any other form. On the borders of the Chowan, immense quantities of herrings are often used as manure, when purchasers cannot take off the myriads supplied by the seines. A herring is buried under each corn-hill, and fine crops are thus made as far as this singular mode of manuring is extended. But whatever benefits have been thus derived, the sense of smelling, as well as the known chemical products of the process of animal putrefaction, make it certain that nine-tenths of all this rich manure, when so applied, must be wasted in the air. If those who fortunately possess this supply of animal manure would cause the fermentation to take place and be completely mixed with and enclosed by marl, in pits of suitable size, they would increase prodigiously both the amount and permanency of their acting animal manure, besides obtaining the benefit of the calcareous earth mixed with it.

But without regarding such uncommon or abundant sources for supplying animal matter, every farmer may considerably increase his stock of putrescent manure by using the preservative power of marl; and all the substances that might be so saved are not only now lost to the land, but serve to contaminate the air while putrefying, and perhaps to engender diseases. The last consideration is of most importance to towns, though worthy of attention every where. Whoever will make the trial will be surprised to find how much putrescent matter may be collected from the dwelling-house, kitchen, and laundry of a family; and which if accumulated (without mixture with calcareous earth,) will soon become so offensive as to prove the necessity of putting an end to the practice. Yet it must be admitted that when all such matters are scattered about, (as is usual both in town and country,) over an extended surface, the same putrefaction must ensue, and the same noxious effluvia be evolved, though not enough concentrated to be very offensive, or even always perceptible. The same amount is inhaled—but in a very diluted state, and in small though incessantly repeated doses. But if mild calcareous earth in any form (and fossil shells or marl present much the cheapest) is used to cover and mix with the putrescent matters so collected, they will be prevented from discharging offensive effluvia, and preserved to enrich the soil. A malignant and ever acting enemy will be converted to a friend and benefactor.

The usual dispersion and waste of such putrescent and excrementitious matters about a farm house, though a considerable loss to agriculture, may take place without being very offensive to the senses, or manifestly injurious to health. But the case is widely different in towns. There, unless great care is continually used to remove or destroy filth of every kind, it soon becomes offensive, if not pestilential. During the summer of 1832, when that most horrible scourge of the human race, the Asiatic cholera, was desolating some of the towns of the United States, and all expected to be visited by its fatal ravages, great and unusual exertions were every where used to remove and prevent the accumulation of filth, which, if allowed to remain, it was supposed would invite the approach, and aid the effects of the pestilence. The efforts made for that purpose served to show

what a vast amount of putrescent matter existed in every town, and which was so rapidly reproduced, that its complete riddance was impossible. Immense quantities of the richest manures, or materials for them, were washed away into the rivers—caustic lime was used to destroy them—and the chloride of lime to decompose the offensive products of their fermentation, when that process had already occurred. All this amount of labor and expense was directed to the complete destruction of what might have given fertility to many adjacent fields—and yet served to cleanse the towns but imperfectly, and for a very short time. Yet the object in view might have been better attained by the previous adoption of the proper means for preserving these putrescent matters, than by destroying them. These means would be to mix or cover all accumulations of such matters with rich marl, (which would be the better for the purpose if its shells were in small particles,) and in such quantity as the effect would show to be sufficient. But much the greater part of the filth of a town is not, and cannot be accumulated; and from being dispersed is the most difficult to remove, and is probably the most noxious in its usual course of fermentation. This would be guarded against by covering thickly with marl the floor of every cellar and stable, back yard and stable lot. Every other vacant space should be lightly covered. The same course pursued on the gardens and other cultivated grounds would be sufficiently compensated by their increased products that would be obtained. But independent of that consideration, the manures there applied would be prevented from escaping into the air; and being wholly retained by the soil, much smaller applications would serve. The level streets ought also to be sprinkled with marl, and as often as circumstances might require. The various putrescent matters usually left in the streets of a town alone serve to make the dirt scraped from them a valuable manure; for the principal part of the bulk of street dirt is composed merely of the barren clay brought in upon the wheels of wagons from the country roads. Such a cover of calcareous earth would be the most effectual absorbent and preserver of putrescent matter, as well as the cheapest mode of keeping a town always clean. There would be less noxious or offensive effluvia than is generated in spite of all the ordinary means of prevention; and by scraping up and removing the marl after it had combined with and secured enough of putrescent matter, a compost would be obtained for the use of the surrounding country, so rich and so abundant, that its use would repay a large part, if not the whole of the expense incurred in its production. Probably one covering of marl for each year would serve for most yards, cellars, &c.; but if required oftener, it would only prove the necessity for the operation, and show the greater value in the results. The compost that might be obtained from spaces equal to five hundred acres, in a populous town, would durably enrich thrice as many acres of the adjacent country; and after twenty years of such a course, the surrounding farms might be capable of returning to the town a ten-fold increased surplus product. After the qualities and value of the manure so formed were properly estimated, it would be used for farms that would be out of the reach of all other calcareous manures. Carts bringing country produce to market might with profit carry back loads of this compost eight or ten miles. The annual supply that the country might be furnished with would produce very different effects from the putrescent and fleeting manure now obtained from the town stables. Of the little durable benefit heretofore derived from such means, the appearance of the country offers sufficient testimony. At three miles distance from some of the principal towns in Virginia, more than half the cultivated land is too poor to yield any farming profit. The surplus grain sent to market is very incon-

siderable—and the coarse hay from the wet natural meadows can only be sold to tavern-keepers, or those who feed horses belonging to other persons —and to whom that hay is the most desirable that is least likely to be eaten.

But even if the waste and destruction of manure in towns were counted as nothing, and the preservation of health by keeping the air pure were the only object sought, still calcareous earth, as presented by rich marl, would serve the purpose far better than quick-lime. It is true that the latter substance acts powerfully in decomposing putrescent animal matter, and destroys its texture and qualities so completely, that the operation is commonly and expressively called "burning" the substances acted on. But to use a sufficient quantity of quick-lime to meet and decompose all putrescent animal matters in a town would be intolerably expensive, and still more objectionable in other respects. If a cover of dry quick-lime in powder was spread over all the surfaces requiring it for this purpose, the town would be unfit to live in; and the nuisance would be scarcely less, when rain had changed the suffocating dust to an adhesive mortar. Woollen clothing, carpets, and even living flesh, would be continually sustaining injury from the contact. No such objections would attend the use of mild calcareous earth; and this could be obtained probably for less than one-fifth of the cost of quick-lime, supposing an equal quantity of pure calcareous matter to be obtained in each case. At this time the richest marl on James river may be obtained at merely the cost of digging, and its carriage by water, which, if undertaken on a large scale, could not exceed, and probably would not equal, two cents the bushel.*

The putrescent animal matters that would be preserved and rendered innoxious by the general marling of the site of a town, would be mostly such as are so dispersed and imperceptible that they would otherwise be entirely lost. But all such as are usually saved in part would be doubled in quantity and value, and deprived of their offensive and noxious qualities, by being kept mixed with calcareous earth. The importance of this plan being adopted with the products of privies, &c., is still greater in town than country. The various matters so collected and combined should never be applied to the soil alone, as the salt derived from the kitchen, and the potash and soap from the laundry, might be injurious in so concentrated a form. When the pit for receiving this compound is emptied, the contents should be spread over other and weaker manure, before being applied to the field.

Towns might furnish many other kinds of rich manure, which are now lost entirely. Some of these particularly require the aid of calcareous earth to be secured from destruction by putrefaction, and others, though not putrescent, are equally wasted. The blood of slaughtered animals, and the waste and rejected articles of wool, hair, feathers, skin, horn and bones, all are manures of great richness. We not only give the flesh of dead animals to infect the air, instead of using it to fertilize the land, but their bones, which might be so easily saved, are as completely thrown away. Bones are composed of phosphate of lime and gelatinous animal matter, and, when crushed, form one of the richest and most convenient manures in the world. They are shipped in quantities from the continent of Europe, and latterly even from this country, to be sold for manure in England. The fields of battle have been gleaned, and their shallow graves emptied for this purpose: and the bones of the ten thousand British heroes, who fell on the field of Waterloo, are now performing the less glorious, but more useful purpose of producing, as manure, bread for their brothers at home.

* Such was the case in 1833 when this part was first published; but now a half cent the bushel is the usual price charged for the best marl, as it lies in the river banks.

There prevails a vulgar but useful superstition, that there is "bad luck" in throwing into the fire any thing, however small may be its amount or value, that can serve for the food of any living animal. It is a pity that the same belief does not extend to every thing that as manure can serve to feed growing plants—and that even the parings of nails and clippings of beards are not saved (as in China) for this purpose. However small each particular source might be, the amount of all the manures that might be saved, and which are now wasted, would add incalculably to the usual means for fertilization. Human excrement, which is scarcely used at all in this country, is stated to be even richer than that of birds; and if all the enriching matters were preserved that are derived not only from the food, but from all the habits of man, there can be no question but that a town of ten thousand inhabitants, from those sources alone, might enrich more land than could be done from as many cattle.

The opinions here presented are principally founded on the theory of the operation of calcareous manures, as maintained in the foregoing part of this essay, but they are also sustained to considerable extent by facts and experience. The most undeniable practical proof of one of my positions is the power of a cover of marl to prevent the escape of all offensive effluvia from the most putrescent animal matters. Of this power I have made continued use for about eighteen months, and know it to be more effectual than quick-lime, even if the destructive action of the latter was not objectionable. Quick-lime forms new combinations with putrescent substances, and, in thus combining, throws off effluvia, which, though different from the products of putrescent matter alone, are still disagreeable and offensive. Mild lime on the contrary absorbs and preserves every thing—or at least prevents the escape of any offensive odor being perceived. Whether putrescent vegetable matter is acted on in like manner by calcareous earth cannot be as well tested by our senses, and therefore the proof is less satisfactory. But if it is true that calcareous earth acts by combining putrescent matters with the soil, and thus preventing their loss, (as I have endeavored to prove in chapter viii.) it must follow that, to the extent of such combination, the formation and escape of all volatile products of putrefaction will also be prevented.

But it will be considered that the most important inquiry remains to be answered, to wit: Has the application of calcareous manures been found in practice decidedly beneficial to the health of the residents on the land? I answer, that long experience, and the collection and comparison of numerous facts derived from various sources, will be required to remove all doubts from this question; and it would be presumptuous in any individual to offer as sufficient proof, the experience of only ten or twelve years on any one farm. But while admitting the insufficiency of such testimony, I assert that, so far, [to 1833,] my experience decidedly supports my position. My principal farm, until within some four or five years, was subject in a remarkable degree to the common mild autumnal diseases of our low country. Whether it is owing to marling, or other unknown causes, these bilious diseases have since [to 1833] become comparatively very rare. Neither does my opinion in this respect, nor the facts that have occurred on my farm, stand alone. Some other persons are equally convinced of this change on other land as well as on mine. But in most cases where I have made inquiries as to such results, nothing decisive had then been observed. The hope that other persons may be induced to observe and report facts bearing on this important point has in part caused the appearance of these crude and perhaps premature views.

Even if my opinions and reasoning should appear sound, I am aware

that the practical application is not to be looked for soon; and that the scheme of using marl in towns is more likely to be met by ridicule, than to receive a serious and attentive examination. Notwithstanding this anticipation, and however hopeless of making converts, either of individuals or of corporate bodies, I will offer a few concluding remarks on the most obvious objections to, and benefits of the plan. The objections will all be resolved into one—namely, the expense to be encountered. The expense certainly would be considerable; but it would be amply compensated by the gains and benefits. In the first place, the general use of marl as proposed, for towns, would serve to insure cleanliness, and purity of the air, more than all the labors of their boards of health and their scavengers, even when acting under the dread of approaching pestilence. Secondly, the putrescent manures produced in towns, by being merely preserved from waste, would be increased ten-fold in quantity and value. Thirdly, all existing nuisances and abominations of filth would be at an end; and the beautiful city of Richmond (for example) would not give offence to our nostrils, almost as often as it offers gratification to our eyes. Lastly, the marl, (or mild lime,) after being used until saturated with putrescent matter, would retain all its first value as calcareous earth, and be well worth purchasing and removing to the adjacent farms, independent of the enriching manure with which it would be loaded. If these advantages can indeed be obtained, they would be cheaply bought at any price necessary to be encountered for the purpose.

The foregoing part of this chapter was first published in the Farmers' Register, (for July, 1833,) as supplementary to the previous edition of this essay. That publication drew some attention from others to the subject, and served to elicit many important facts, of which I had been before altogether ignorant, in support of the operation of calcareous earth in arresting the effects of *malaria*, or the usual autumnal diseases of the southern states and other similar regions. These facts, together with the result of my own personal experience, extended through two more autumns, (or sickly seasons, as commonly called here and farther south,) since the first publication of these views, will now be submitted. Most of the facts derived from other persons relate to one region, the "rotten lime-stone lands" of southern Alabama; but that region is extensive, is of remarkable and well known character and peculiarities, and the evidence comes from various sources, and is full, and consistent in purport. The facts will be here presented in an abridged form. The several more full communications, from which they are drawn, may be referred to in the Farmers' Register, vol. i., pp. 152, 214 and 277.

The first fact brought out was that, in the town of Mobile near the Gulf of Mexico, the streets actually had been paved or covered with shells —thus presenting precisely such a case as I recommended, though not with any view to promoting cleanliness or health. The shells had been used merely as a substitute for stones, which could not be so cheaply obtained. Nor had the greatly improved healthiness of Mobile, since the streets were so covered, (of which there is the most ample and undoubted testimony,) been attributed to that cause, until the publication of the foregoing opinions served to connect them as cause and effect. This can scarcely be doubted by those who will admit the theory of the action of calcareous earth; and the remarkable change from unhealthiness in Mobile, to comparative healthiness, is a very strong exemplification of the truth of the theory. But it is not strange, when so many other causes might (and probably did) operate to arrest disease, that none should have considered the chemical operation of the shelly pavement as one of them, and still less as the one

by far the most important. The paving of streets, (with any material,) draining and filling up wet places, substituting for rotting wooden buildings new ones of brick and stone—and especially the operation of destructive and extensive fires—all, we know, operate (and particularly the last) to improve the healthiness of towns; and all these operated at Mobile, as well as shelling the streets. Neither was the shelling so ordered as to produce its best effect for health. The streets, alleys, and many yards and small vacant lots were covered, and so far the formation and evolving of pestilential effluvia were lessened. But as this was not the object in view, and indeed the chemical action of shells was not thought of, the process was incomplete, and must necessarily have been less effectual than it might have been made. The shelling ought to have been extended to every open spot where filth could accumulate—to every back yard, in every cellar, and made the material of the floor of every stable, and every other building of which the floor would otherwise be of common earth. In addition, after a sufficient lapse of time to saturate with putrescent matters the upper part of the calcareous layer, and thus to make it a very rich compound, there should have been a partial or total removal of the mass, and a new coating of shells laid down. The value of the old material, as manure, would probably go far towards paying for this renewal. If it is not so renewed, the calcareous matter cannot combine with more than a certain amount of putrescent matters; and, after being so saturated, can have no further effect in saving such matters for use, or preventing them from having their usual evil course.

The burning of towns is well known to be a cause of the healthiness of the places being greatly improved, and that such effect continues after as many buildings, or more, have replaced those destroyed by fire. Indeed this improvement is considered so permanent, as well as considerable, that the most sweeping and destructive conflagrations of some of our southern towns have been afterwards acknowledged to have proved a gain and a blessing. The principal and immediate mode of operation of this universally acknowledged cause is usually supposed to be the total destruction, by the fire, of all filth and putrescent matters; and in a less degree, and more gradually, by afterwards substituting brick and stone for wooden buildings, which are always in a more or less decayed state. But though these reasons have served heretofore to satisfy all, as to the beneficial consequences of fires, surely they are altogether inadequate as causes for such great and durable effects. The mere destruction of all putrescent matters in a town, at any one time, would certainly leave a clear atmosphere, and give strong assurance of health being improved for a short time afterwards. But these matters would be replaced probably in the course of a few months, by the residence of as many inhabitants, and the continuance of the same general habits; and most certainly this cause would lose all its operation by the time the town was rebuilt. But there is one operation produced by the burning of a town, which is far more powerful—which in fact is indirectly the very practice which has been advocated—and the effect of which, if given its due weight, furnishes proof of the theory set forth, by the experience of every unhealthy town which has suffered much from fire. If a fair estimate is made of the immense quantity of mild calcareous earth which is contained in the plastering and brick-work of even the wooden dwelling-houses of a town, and still more of those built of masonry, it must be admitted that all that material being separated, broken down, (soon or late,) and spread, by the burning of the houses and pulling down their ruins, is enough to give a very heavy cover of calcareous earth to the whole space of land burnt over. It is to this operation, in a far

greater degree than to all others, that I attribute the beneficial effects to health of the burning of towns.

I proceed to the facts derived from the extensive body of prairie lands in Alabama which rest on a substratum of soft lime-stone, or rich indurated clay marl. It was from these remarkable soils that the specimens were obtained which were described at pp. 42, 43. Some of these, indeed all that have been examined by chemical tests, of the high and dry prairie lands, contain calcareous earth in larger proportions than any soils of considerable extent in the United States that I have seen or tested. The specimens not containing free calcareous earth are of the class of neutral soils; and the calcareous earth, which doubtless they formerly contained, and from which they derived their peculiar and valuable qualities, may be supposed only to be concealed by the accumulation of vegetable matter, according to the general views submitted in chapter vii. The more full descriptions of the soils of this remarkable and extensive region before referred to render it unnecessary to enlarge much here. It will be sufficient to sum up concisely the facts there exhibited—and which agree with various other private accounts which have been received from undoubted sources of information. The deductions from these facts, and their accordance with the theory of the operation of calcareous matter, are matters of reasoning, and, as such, are submitted to the consideration and judgment of readers.

The soil of these prairie lands is very rich, except the spots where the soft lime-stone rises to the surface, and makes the calcareous ingredient excessive. In the specimen formerly mentioned, the pure calcareous matter formed 59 parts in the 100 of this "bald prairie" land. The soil generally has so little of sand, that nothing but the calcareous matter which enters so largely into its composition prevents it being so stiff and intractable, that its tillage would be almost impracticable; yet it is friable and light when dry, and easy to till. But the superfluous rain water cannot sink and pass off, as in sandy or other pervious lands, but is held in this close and highly absorbent soil, which throughout winter is thereby made a deep mire, unfit to prepare for tillage, and scarcely practicable to travel over. This water-holding quality of the soil, and the nearness to the surface of the hard and impervious marly substratum, deprive the country of natural springs and running streams; and before the important discovery was made that pure water might be obtained by boring from 300 to 700 feet through the solid calcareous rock, the inhabitants used the stagnant rain water collected in pits, which was very far from being either pure or palatable. Under all these circumstances, added to the rank herbage of millions of acres annually dying and decomposing under a southern sun, it might have been counted on, as almost certain, that such a country would have proved very unhealthy. Yet the reverse is the fact, and in a remarkable degree. The healthiness of this region is so connected with and limited by the calcareous substratum and soil, that it could not escape observation; and they have been considered as cause and effect by those who had no theory to support, and who did not spend a thought upon the mode in which was produced the important result they so readily admitted. Their testimony therefore is in this respect the more valuable, because it cannot be suspected of having any such bias.

To the time when this last publication is made, (1842,) there has been no reason to doubt the actual facts of autumnal diseases (the effects of *malaria*) being greatly lessened by even the partial use of marling; nor the inference that they would almost cease to occur, (if no mill-ponds and undrained lands remained,) if all the surface of a considerable extent of country were made calcareous, and all rapidly putrescent and otherwise

offensive matter were preserved and kept harmless by being combined with marl, applied from time to time as required. But it should be remembered that, as yet, rapid and extensive as has been the progress of marling in Virginia, there has been no instance of the greater part of any whole neighborhood of so much as a few miles in extent being marled; nor even of all the surface of any one farm; and that, therefore, we have no means of judging by experience of the full measure of benefit to be derived from such a general change of the character of the soil. The most that has yet been done any where is the marling of all the cultivated and arable land; leaving unmarled, and as much as ever the abundant sources of vegetable decomposition and of disease, all the wood-land, hill-sides, and the wet bottoms. Now, as the remaining wood-lands are generally among the poorest of our soils, that is, (according to the theory maintained,) soils incapable of combining with and retaining the products of decomposition—and as they are covered annually with leaves, which in time all rot and their gaseous products finally pass off into the air—it follows, that the lands so left are among the most fruitful of malaria. It is obvious that the remedy is but partially and inefficiently in operation, so long as from one third to one half of every farm is left unmarled, and as free as ever to evolve the agent of disease. So sure does this opinion seem to me, that I have commenced acting on it, by marling the wood-land that is not designed to be cleared for cultivation—and shall continue, as more necessary labors permit, to do so, until not an acre of the farm is left without being changed in character by calcareous earth.

It is proper to add, as an opinion founded on but limited experience as yet, that though the cases of sickness on Coggins Point farm have certainly diminished very greatly—there not being one case of late years of bilious diseases, where there were twenty formerly—still that the diseases seem to have changed in kind, and to have increased in severity and danger. Formerly, there was almost no sickness except from ague and fever, (or, very rarely, a case of mild bilious fever,) from which, though few persons escaped through the autumn, and some suffered several relapses, the attacks were rarely dangerous, and required little skill, and but a few days to cure, for that time. Bad as was this state of things, it seemed that the ague and fever acted as a safely-valve to the system, and while it seldom permitted the enjoyment of long continued robust health, it prevented the occurrence of more dangerous or fatal diseases, such as are the most common among the fewer diseases of what are deemed healthy regions. The fewer diseases of my adult negroes for the last twelve or thirteen years have been of a more inflammatory kind, and are not confined to autumn; and there have been certainly more severe and fatal diseases, and more that required medical aid, than formerly, when there was so much more of sickness of one kind, and confined to one season. In short, it seems that the diseases are no longer (or but in few cases) those of the low country and of a bilious climate, but are more like those of the upper country, which, though occurring but rarely, are generally of a more serious nature. The facts on which this particular opinion has been formed, are still too few, and of too short continuance, to attach to them much importance; and even if they were less doubtful, I have not the medical knowledge to trace these new effects back to their causes. Still, it is deemed due to candor, and to the desire for a fair and full investigation of the subject, even if making against my own views, that these opinions should be stated. There is no other subject, than this, taken in general, which more deserves and requires investigation; and in the present inchoate state of the discussion, the expression of even erroneous opinions

will not be useless, if it should serve to elicit more full or correct ones from other sources.

Nothing better than this one subject deserves investigaton by medical men, acting under the direction of government. The materials for information are now abundant, in the experience and observation of the numerous farmers who have marled or limed their lands long enough to judge of the effects on health; and whether upon true or false grounds, the opinion among such persons seems now (1842) almost universal, (so far as I have heard opinions expressed,) that the prevalence of autumnal diseases, the product of malaria, has been invariably and manifestly lessened since the lands were in part marled or limed. My individual experience and observations on this point, now of nine years' more extent than when the first fruits thereof were stated in a foregoing part of this chapter, concur with the more general and loose information derived from others, in confirming my position. It sometimes happens that the very fact of an opinion being universally admitted prevents the obtaining such proofs of its truth as would certainly have been ready, if the opinion had been questioned and denied by many skeptics. And such is the state of the proposition now under consideration. Even in the few years which have passed since I first advanced the opinion that the use of calcareous manures served to improve health, that opinion has become so general, and is deemed so certain and unquestionable, by those persons who have used those manures, that but few facts can be learned of them sufficiently exact to serve as proofs; because no person has deemed it necessary to collect and preserve proofs of what none doubted. When asking for such proofs, as I have often done, of cultivators and residents in various parts of the marl region, I have rarely obtained any, except new declarations, from every person interrogated, of concurrence and entire faith in the general opinion that marling or liming had served greatly to abate the prevalence of autumnal diseases. Such general belief and confidence in an opinion so recently entertained and promulgated, cannot be altogether founded on error.

When my opinions of the beneficial operation of calcareous earth in soil, or mixed with putrescent matter, in destroying or disarming the sources of disease, were first published, and until after the last publication of the same in 1835, I had no knowledge that similar grounds had been taken by any other person. But since, in the recent publications of a French writer, M. Puvis, I have found the same general opinion expressed, and many important facts given in confirmation. However, while I gladly accept the important aid of M. Puvis' facts, as proof, I do not admit the correctness of his reasoning thereupon. Some of the former will be quoted in the following passages. For his full views, see the translations of his essays 'On Lime as Manure,' and 'On Marl,' both contained in vol. iii. of the Farmers' Register.

"The results of marling may be considered in a point of view more elevated, and still more important than that of the fertility which it gives to the soil; they may perhaps have much influence on the healthiness of a country where it becomes a general practice.

"Although it may not have been yet uttered by others, this opinion appears founded on strong probabilities, on strong analogies and precise facts, all of which appear to give it a sufficient certainty.

"It is known that the calcareous principle is one of the most powerful agents to resist putrefaction. It is employed to make healthy places inhabited by men and animals, in which sickness or contagion is feared; it serves to neutralize the emanations of dead bodies undergoing putrefaction; it destroys the deleterious exhalations which escape from privies, and which sometimes cause the death of those who are employed to cleanse them.

"It even seems that calcareous countries are unhealthy only when they are interspersed by marshes, or when some causes, foreign to the soil and climate, determine the unhealthiness, as in countries on the borders of the sea, where the flowing of the tide and the mingling of salt and fresh waters infect the air, by the deleterious emanations of their combination. This cause of unhealthiness is regarded as a certain fact; for salubrity is generally seen to appear whenever this mixture of waters is prevented.

"In the valleys of rivers bordered by calcareous mountains, which enclose unhealthy countries in their interior, insalubrity commences there only as the calcareous soil, which is attached to the mountain, gives place to silicious soil. In the same plain, and far from a mountain, salubrity is seen to diminish in the same proportion that the calcareous soil of the surface does; and the *communes* of Bresse, which have an abundance of marly or calcareous soils, are much more remarkable for their salubrity than those on the white lands (*terrain blanc**.) While the ponds of Dombe, which are on the silicious soil, appear to be one of the greatest causes of unhealthiness, those of Bresse, which are on calcareous lands, do not show such effects in the country where they are found; so, likewise, the ponds of the country situated between the Veyle and the Reyssouze, to the north-west of Bourg, which are generally on calcareous soil, do not appear to injure the healthiness of the country in any manner.

"For the support of this system, we will also cite the ponds of Berri on calcareous soil, whose emanations have nothing unhealthy; the laying dry of the ponds of Parragay, in the canton of Lignieres, has added nothing to the healthiness of a calcareous country naturally healthy. And in the same canton, the pond of Villiers, which is said to be seven leagues in circumference, does not cause diseases on its borders. Besides, during the month of August, the water of the ponds on calcareous soil does not become blackish, as often happens in silicious ponds. The water would then be made wholesome by the calcareous principle, in the same way as their emanations.

"In fine, Dombe and Sologne, and a number of other countries are unhealthy, and subject to intermittent fevers, without being marshy; but their soil is likewise silicious, and the land moist. Puisaye, and a part of Bresse, in similar land, which contain little or no calcareous soil, have also many autumnal fevers."—(*Translation from 'Essai sur la Marne.'*)

CHAPTER XVI.

DIRECTIONS FOR THE MECHANICAL OPERATIONS OF APPLYING MARL AS MANURE.

The great deposite of fossil shells, which custom has miscalled marl, is in many places exposed to view in most of the lands that border on our tide-waters, and on many of their small tributary streams. Formerly, it was supposed to be limited to such situations; but since its value as a manure has caused it to be more noticed and sought after, marl has been found in many other places. It is often discovered by the digging of wells, but lying so deep that its value must be more highly estimated than at

* The reader of M. Puvis' essays on lime and marl, which were inserted in vol. iii., may remember that this provincial term and others (*plateaux argillo-silicieux*, &c.) were there used to designate a peculiar kind of soil, destitute of calcareous matter, stiff, intractable and poor—and which seems precisely of the character of the poor ridge lands of lower Virginia, to which calcareous manures are so peculiarly adapted.—*Translator.*

present before it will be dug for manure. From all the scattered evidences of the presence of this deposite, it may be inferred that it lies beneath nearly every part of our country between the sea and the granite ridge which forms the falls of all our rivers. It is exposed where it rises, and where cut through by the deep ravines of hilly land and by the courses of rivers—and concealed by its dips, and the usual level surface of the country. The rich tracts of neutral soil on James river, such as Shirley, Westover, Brandon, and Sandy Point, seem to have been formed by alluvion, which may be termed recent compared to that of our district in general; and in these no marl has been found, though it is generally abundant in the adjacent higher lands. Fresh-water muscle shells are sometimes found in thin layers, (from a few inches to two feet thick,) both on these lands and others—but generally near the surface, and always far above the deposite of sea shells, found under the high land. These two layers of different kinds of shells are separated by a thickness of many feet of earth, containing no shells of any kind. Muscle shells are richer than the others, as they contain much gelatinous and enriching animal matter. On this account, the earth with which muscle shells are found mixed is a rich black mould. Most persons consider these beds of muscle shells as artificially formed by the Indians, who are supposed to have collected the muscles for food, and left the shells where the fish were consumed. There are some strong reasons which may be adduced both to sustain and to oppose this opinion. But whatever may be the origin of these collections of muscle shells, it does not affect their qualities as manure for the soils in which they are found, or for others to which they may be removed.

Neither the fossil sea shells, nor the earth mixed with them, are supposed to contain any important or considerable proportion of putrescent matter —and this manure has been considered throughout this essay as being valuable *only as containing calcareous earth*. This, no doubt, is the only ingredient of any worth, in the great majority of cases. But sometimes there are other ingredients— which must be considered merely as exceptions to the general rule. One of these exceptions has already been stated, in the description of gypseous marl, (page 92;) and some others have been discovered since the publication of that statement. A kind of earth, containing a large proportion of carbonate of magnesia, as well as of carbonate nate of lime, has been found in Hanover county, Va. (*Farmers' Register, vol. i.*) Professor Rogers, of William and Mary College, has discovered, in many of the marls of lower Virginia, some proportion of the "green sand" of geologists, or what is itself called "marl," (another misapplication of that name,) in New Jersey, and which has there been found highly valuable as manure, though containing not a particle of the carbonate of lime, which constitutes the sole value of shells and calcareous manures in general. The formation or body of this green-sand, separate and distinct from any marl, I had discovered long before, and of which a full account will be given in a subsequent part of this essay. But however interesting may be the discovery of these different ingredients of particular bodies of marl, and however valuable they may prove as manures, still they are not to be considered as treated of in this essay under any general observations on *marl*—which observations are designed to be applied simply to manure of which the only useful ingredient is the *carbonate of lime*.

More than a hundred kinds of sea shells are found in the beds of marl, that I have worked, without counting any of very small size. Many kinds would escape common observation, and others would require the aid of a magnifying glass to be distinguished. Generally the shells, though fragile, are entire, but are much broken by the digging, and after-operations. The

white shells are rapidly reduced, after being mixed with an acid soil; but some gray kinds, as the scallop and the oyster, are so hard as to be very long before they can act as manure. Some beds, and they are generally the richest, have scarcely any whole shells, but are formed principally of small broken fragments. Of course the value of marl as a manure depends in some measure on which kinds of shells are most numerous, and their state of division, as well as upon the total amount of the calcareous earth contained. The last is however by far the most important criterion of value. The most experienced eye may be much deceived in the strength of marl; and still more gross and dangerous errors would be made by an inexperienced marler. The strength of a body of marl often changes materially in sinking a foot in depth—although the same changes may be expected to occur very regularly, in every pit sunk through the same bed. Whoever uses marl ought to know how to analyze it, which a little care will enable any one to do with sufficient accuracy. The method described, at page 35, for ascertaining the proportions of calcareous earth in soils, will of course serve for the same purpose with marl. But as more particular and minute directions may be necessary for many persons who will use this manure, and who ought to be able to judge of its value, such directions will be here given, and which any one can follow by merely applying sufficient attention and care. To perform this process will require no other chemical tests than muriatic acid and carbonate of potash, and no apparatus, except small scales and weights, a glass funnel and some blotting or very porous printing paper—all of which may be bought at any apothecary's shop.

Directions for analyzing marl by solution and precipitation.

1st. Take a lump of marl, fossil shells, &c., large enough to furnish a fair sample of the particular body under consideration—dry it perfectly near the fire—pound the whole to a coarse powder (in a metal mortar,) and mix the whole together. Take from the mixture a small sample, which reduce to a finely divided state, and weigh of it a certain portion, say 50 grains, for trial.

2d. To this known quantity, in a glass, pour slowly and at different times muriatic acid diluted with three or four times its bulk of water—(any except limestone, or *hard* water.) The acid will dissolve all the lime in the calcareous earth, and let loose the carbonic acid, with which it was previously combined, in the form of gas, or air, which causes the effervescence, which so plainly marks the progress of such solution. The addition of the muriatic acid must be continued as long as it produces effervescence; and but very little after that effect has ceased. The mixture should be well and often stirred, and should have enough excess of acid to be sour after standing thirty or forty minutes. (So much of the acid as the lime combines with loses its sour taste, as well as its other peculiar qualities.)

The mixture now consists of 1, the lime combined chemically with muriatic acid, forming *muriate of lime*, which is a *salt*, and which is dissolved in the water—2, a small excess of muriatic acid mixed with the fluid—and 3, the sand, clay and any other insoluble parts of the sample of marl. To separate the solid from the fluid and soluble parts is the next step required.

3rd. Take a piece of filtering or blotting paper, about six or eight inches square, (some spongy and unsized newspapers serve well,) fold it so as to fit within a glass funnel, which will act better if its inner surface is fluted. Pour water first into the filter, so as to see whether it is free from any hole,

or defect; if the filtering paper operates well, throw out the water, and pour into it the whole mixture. The fluid will slowly pass through into a glass under the funnel, leaving on the filter all the solid parts, on which water must be poured once or twice, so as to wash out, and convey to the solution, every remaining particle of the dissolved lime.

4th. The solid matter left, after being thus washed, must be taken out of the funnel on the paper, and carefully and thoroughly dried—then scraped off the paper and weighed. The weight, say 27 grains, being deducted from the original quantity, 50, would make the part dissolved (50—27= 23) 46 per cent. of the whole. And such may be taken as very nearly the proportion of calcareous earth (or carbonate of lime) in the earth examined. But as there will necessarily be some loss in the process, and every grain taken from the solid parts appears in the result as a grain added to the carbonate of lime, it will be right in such partial trials to allow about two per cent. for loss, which allowance will reduce the foregoing statement to 44 per cent. of carbonate of lime.

5th. But it is not necessary to rely altogether on the estimate obtained by subtraction, as it may be proved by comparison with the next step of the process. Into the solution (and the washings) which passed through the filter, pour gradually a solution of *carbonate of potash.* The first effect of the alkaline substance, thus added, will be to take up any excess of muriatic acid in the fluid—and next, to precipitate the lime (now converted again to carbonate of lime,) in a thick curd-like form. When the precipitation is ended, and the fluid retains a strong taste of the carbonate of potash, (showing it to remain in excess,) the whole must be poured on another filtering paper, and (as before,) the solid matter left thereon repeatedly washed by pouring on water, then dried, scraped off, and weighed. This will be the actual proportion of the calcareous part of the sample, except, perhaps, a loss of one or two grains in the hundred. The loss, therefore, in this part of the process apparently lessens, as the loss in the earlier part increases the statement of the strength of the manure. The whole may be supposed to stand then:

27 grains of sand and clay
21 —— of carbonate of lime } = 50.
2 —— of loss

If the loss be divided between the carbonate of lime and the other worthless parts of the manure, it will make the proportion 28 and 22, which will be probably near the actual proportions.

The foregoing method is not the most exact, but is sufficiently so for practical use. All the errors to which it is liable will not much affect the reported result—unless magnesia is present, and that is not often in manures of this nature. Magnesia is never found (I believe) in the deposites of fossil shells—nor have I known of its presence in any of the earthy manures, except lime-stone, and the magnesian marl discovered in Hanover. If any considerable proportion of carbonate of magnesia should ever be present in marl tried by the foregoing method, it may be suspected by the effervescence being very slow compared to that of carbonate of lime alone; and the proportions of these two earths may be ascertained as follows. The magnesia as well as the lime would be dissolved by the muriatic acid, (applied as above directed,) but the magnesia would not be precipitated with the carbonate of lime, but would remain dissolved in the alkaline solution, last separated by filtering. If this liquor is poured into a Florence flask and boiled for a quarter of an hour, the carbonate of magnesia will fall to the bottom, and may then be separated by filtering and washing, and its quantity ascertained by being dried and weighed. This

part of the process may be easily added to the foregoing— but it will very rarely be required.

If desired, the proportion of silicious and aluminous earth may be ascertained, with enough truth for practical use, by stirring well these parts (minutely divided) in a glass of water, and after letting it stand a minute, for the sand to subside, pouring off the fluid into another glass. The sand will be left, and the finely divided earth and clay pass off with the water, and may be separately collected and dried on filtering paper, and weighed.

For want of attention to the only safe guide, the chemical analysis of marl, gross errors are often committed, and losses continually sustained. By relying on the eye only, I have known marl, or rather a calcareous sand, to be rejected as worthless, and thrown off at considerable cost of labor, to uncover worse marl below, in which whole shells were visible; and on the contrary, earth has been taken for marl, and used as such, which had no calcareous ingredient whatever. The best marls for profitable use are generally such as show the fewest whole shells, or even large fragments—and would be passed by unnoticed in some cases, or considered only as barren sand, or equally worthless clay. But even if such mistakes as these are avoided, every farmer using marl, without analyzing specimens frequently and accurately, will incur much loss by applying it in quantities either too great or too small.

If marl reaches the surface, or "crops out," any where, it may be found most easily by examining the beds of streams passing through the lowest land, or deepest ravines. A few of the smallest particles of shells found there will prove that the stream passes through marl somewhere above; and a careful examination continued towards the source, will scarcely fail to discover where the bed lies. Its usual direction is horizontal, or very little inclined; and therefore if discovered any where along the sides of a narrow valley, it may generally be found by digging on the opposite side, or elsewhere not very distant at the same elevation on the hill-side; and it is always nearer the surface on swells, or the convex parts of the hill-side, than where it retreats and forms hollows. In the more level parts of the country, the marl sometimes is very near the surface of the lowest land, and yet is not visible any where. In such situations, particularly, a cheap and convenient auger may be used with much advantage in searching for marl; and it is also useful to try the depth or quality of a bed, even when its surface has been found. This tool may be made by welding a straight stem, half an inch square and six or seven feet long, to a common screw auger of about one inch and a half bore. If it has been so much worn as to be useless as a carpenter's tool, it will serve for boring in earth. A cross-piece for a handle should be fixed to slide over the stem, and be fastened by a small screw at different elevations, as most convenient. Other pieces may be added to the stem, attached by joints, so as to bore twelve or more feet deep. Dr. Wm. I. Cocke, formerly of Sussex, to whom I am indebted for this simple but useful tool, was enabled by its use to find a very valuable bed of marl which was no where visible at the surface, and which he used to great extent and advantage.

Mr. Williams Carter, of Hanover, has introduced a simple and useful improvement which greatly facilitates the use of the cheap and light auger just described. When one or more additional joints are required, (for boring to greater depth than seven or eight feet,) the process becomes much more troublesome, because of the necessity for separating and re-uniting the several joints every time the auger is drawn up to take off the earth, which has to be done for every four or five inches of depth gained. This trouble may be avoided by Mr. Carter's method. This is, to have a rough bench,

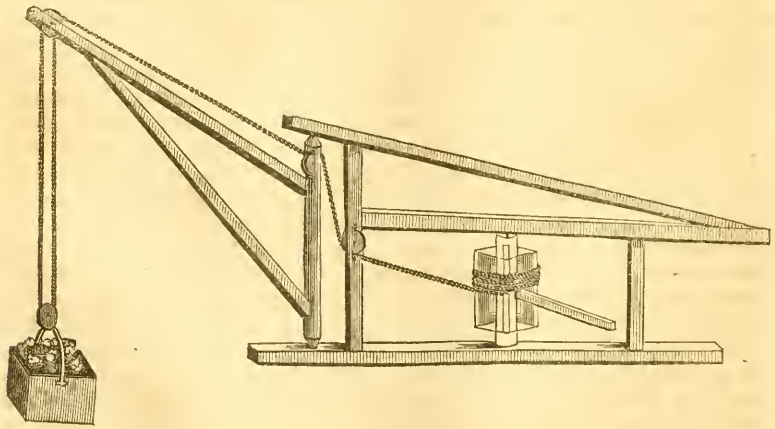
or narrow table, made of a single plank, some 7 or 8 feet long, and having legs 10 or 12 feet in length. A hole large enough for the stem of the auger to turn in freely is in the middle of the bench. As soon as a second joint is attached, the bench is set over the boring, with the hole immediately above, so that when the auger is lifted perpendicularly clear of the boring, its upper joint passes through the hole, and is held up steadily by the support of the bench above. For still greater and unusual depths, another bench with longer legs may be substituted, or a lower one placed upon and confined to the first bench. (*Farmers' Register.*) Such means as these, imperfect as they are, will be found more convenient and more operative, as well as much more cheap, than the heavy and costly augers used to search for coal.

By proper examinations marl may be found at or near the surface through a vast extent of the tide-water region of the United States, where it has not yet been noticed. But still, under most lands it probably does not approach within twenty-five or thirty feet of the surface, and if reached by digging, would be covered by water, so as greatly to increase the difficulty of obtaining it from such depths. Will these obstacles always debar from the benefit of this treasure half the great region under which it lies? I think not. Though it would be ridiculous now to propose such undertakings, it will at some future time be found profitable to descend still greater depths for good marl; and shafts will be sunk and the water and marl drawn out by horse-power or by steam engines, and the excavation carried on in the same manner as is done in coal mines. When such means shall be resorted to, it is probable that there will be but a small portion of the great tide-water region, or the region east of the granite range, in which marl may not be found sufficiently convenient for use. For example: from a mile south of Petersburg, along the line of the railway to the Roanoke, no marl had been found either by the excavations for the road, or in the much deeper wells dug long before in the vicinity of the route. The well for the water-station nine miles from Petersburg did not at all times supply enough water for the engines, and it was determined to dig one deep enough for that purpose. Disregarding the small veins of water usually reached at less than 20 feet, the digging was sunk to 50 feet, when marl was reached. Its quality at top was rather poor; but it became more and more rich, as well as of firmer consistence, (though never very hard,) until the well had been sunk to 80 feet, without reaching the bottom of the marl, or finding any other vein of water. The lower part of this marl was from 80 to 90 per cent. of carbonate of lime, as I found by several analyses. It would have served to make good lime, by burning, for cement or for manure, to be transported to a distance on the railway; besides being of more value to be used unprepared to enrich the nearer land. Though covered by 50 feet of earth, and the excavation impeded by the water from above, this marl might have been profitably raised 80 feet, or as much lower as the bed may extend. And so firm was its texture, that the excavation might have been safely enlarged gradually as it was deepened, as is done in the chalk-pits of England, so as that the digging should form a hollow cone, communicating from its apex by the narrower cylindrical well through the 50 feet of earth above to the surface. Thus though the earth might have been twice the thickness of the marl below, the greater diameter of excavation in the latter would have furnished much the greater quantity of contents. Of this most valuable deposite, found in a region before supposed destitute, and where its transportation to a long line of destitute land was so convenient, no use has been made, except of the quantity necessarily drawn up in digging this well. And this means for enriching the undertaker, and fertilizing a vast extent of surface

of acid and poor land, will probably remain totally neglected for the next fifty years. It is most probable that this same thick and rich body of marl may be found at many miles' distance on the line of rail-road, and indeed wherever the surface is in the same position relative to the granite range.

For taking up marl from any depth, greater than 16 feet, or more than two casts with the shovel will serve for, it will be better to use horse-power applied to machinery. A crane which has been used by Wm. Carmichael Esq., of Queen Ann's county, Md., will serve the purpose. His description of the crane was published in the 'Farmers' Register,' as follows:

"In your 'Essay on Calcareous Manures,' you give instructions for digging and carting marl. This method I pursued for several years, but found the labor hard on my hands, and tedious. Marl here is generally found in deep ravines or in wet grounds. My operations have been slow, from the difficulty of making firm and lasting ways, and the labor of ascending steep hills. Last winter I made a model, and this spring I built a machine for raising marl, to be worked by a horse. I have been using it to advantage, and now send you a draught of it, as it may be useful to those who have wet marl pits like mine. By means of a pump to throw off the water, pits may be worked at a considerable depth; and even if marl is dry, but lies deep, I think the crane may be used to advantage. I use two boxes, and by means of hinges and a latch the marl is discharged from the bottom. I have double blocks; the rope passes through the swoop about eighteen inches from the end, and runs down to the post which supports the swoop, and passes through it on a small roller, and in like manner through the next post to the cylinder, to which a reel is attached to increase the motion. The post which holds the swoop and the cylinder, runs on iron pins let into thimbles. The lever is in two pieces, one fastened in the cylinder with a groove at the end, into which the other is let, and secured by a sliding iron clamp. When the marl is discharged from the box, and the swoop swung round over the pit, in nautical phrase, by unshipping the end of the lever, the rope unwinds, and the box descends without moving the horse. The circle in which the horse travels ought to be twenty-one feet in diameter. The second and third posts supported by side braces.



"The cost of the machine is small, though I cannot make an exact estimate. The carpenter who did the work was hired by the day on the farm,

and was taken off with other jobs; but his bill could not exceed eight dollars. The cost of the iron work was ten, and one hundred and sixty-five feet of inch rope, at eighteen and a half cents a pound. The timber, taken from my own woods, may be estimated at five dollars. The rope I find soon wears out, and I intend to supply its place with a light iron chain.

"When the marl is uncovered, with one efficient hand in the pit and a less efficient one to discharge the boxes and drive the horse, five hundred bushels may be raised in a day. The work is not oppressive to the laborers. The teams stand on high, dry ground; no sloughs to plunge through, and no hill to climb. The swoop is turned by a small rope over the carts, and the marl immediately discharged into them. I work four carts, with two sets of oxen to each. They came out of the winter lean and weak; and now, with green clover for their food, at the distance of a half to three-quarters of a mile I draw out from four to five hundred bushels a day, and my oxen have improved. My work goes on with ease and expedition, without stoppage to mend roads, or to clear ditches."

Our beds of marl are either of a blue, or a yellowish color. The color of the first might be supposed to have some connexion with the presence of water, as this kind is always kept wet by water oozing slowly through it. But the yellow marl is also sometimes wet, though more generally dry. The blue color of marl therefore is not caused by merely the presence of water, or there would be no wet yellow marl. When both blue and yellow marl are seen in the same bed, the blue is always at bottom; and the line of division between the colors is well defined, and there is seen no gradual change of one to the other. I observed, in the year 1834, that as intense and perfect a blue color as marl has ever been known to have was given to what had been dry yellow marl, by its being used as a thick flooring for a stable yard, and kept covered with the rotting manure, and penetrated by its liquid oozings, which the marl was there placed to save. It may be inferred from this fact that blue marls have received their color from some vegetable extract, or other putrescent matter, dissolved in the water passing through the bed.

The dry marls are of course much the easier to be worked. Unless very poor, and sandy, as well as wet, all our marls are sufficiently firm and solid for the sides of the pit to stand secure, when dug perpendicularly.

Where a bed of marl is dry, and not covered by much earth, no directions are required for the pit work—except it be, that the pit should be long enough to allow the carts to descend to the bottom (when finished) and to rise out on a slope sufficiently gradual. This will prevent the necessity of twice handling the marl, by first throwing it out of the pit and then into the carts, which must be done if the pit is made too short, or its ends too steep, for the loads to be drawn out. No machine or contrivance yet known will raise marl from the bottom of a pit, or a valley, so well as a horse cart; and no pains will be lost, in enlarging the pit, and graduating the ascent out of it, to attain that object.

But it is not necessary, nor often convenient, that the carts shall descend as low as the bottom of the excavation. For the lower 6 or 8 feet of the marl to be dug, it is generally best, (after digging an area of sufficient size to the top of that part,) to take out this lower part in small pits, of about 5 feet wide to 7 or 8 in length, with perpendicular ends as well as sides. These pits may be filled with the earth removed from the next adjacent space, cleared off for another digging. If the bed be very wet, or unavoidably subject to inundation from streams swollen by heavy rains, it will be more safe to dig pits as small as the men employed can find space

to dig in and throw out from, and to sink them to 15 or 16 feet, by throwing the lower half on a table, whence another man will throw it to the level where the carts can stand to be loaded. Then each separate pit will soon be completed, and out of danger of bad weather. And if flooded before being finished, the loss of the marl, then remaining not dug, will not be important in so small an excavation.

As marl shows usually on a hill-side, but little earth has to be moved off to uncover the first place for digging. But the next, and each successive cover of earth, will be more thick, until it may be necessary to abandon that place and begin again elsewhere. But the quantity of covering earth need not be regarded as a serious obstacle, if it is not thicker than the marl below it. While that is the case, one pit completed will receive all the earth thrown from an equal space, for commencing another. When this proportion of earth is exceeded, it is necessary to carry it farther, by either wheel-barrows or scrapers, and the labor is thereby greatly increased.

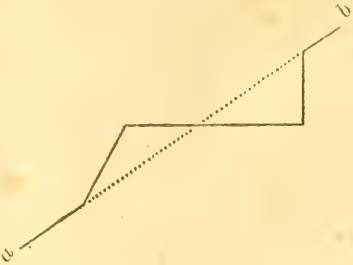
For any extensive operation, it is much cheaper to take off a cover of earth twelve feet thick to obtain marl of equal depth, than if both the covering earth and marl were only three feet each. Whether the cover be thick or thin, two parts of the operation are equally troublesome, viz. to take off the mat of roots, and perhaps some large trees on the surface soil, and to clean off the surface of the marl, which is sometimes very irregular. The greater part of the thickest cover would be much easier to work. But the most important advantage in taking off earth of ten or more feet in thickness, is saving digging by causing the earth to come down by its own weight. If time can be allowed to aid this operation, the driest earth will mostly fall, by being repeatedly undermined a little. But this is greatly facilitated by the oozing water, which generally fills the earth lying immediately on beds of wet marl. In uncovering a bed of this description, for one of my early operations, where the marl was to be dug fourteen feet, and ten to twelve feet of earth to remove, my labor was made ten-fold heavier by digging altogether. The surface bore living trees, and was full of roots—there was enough stone to keep the edges of the hoes battered—and small springs and oozing water came out every where, after digging a few feet deep. A considerable part of the earth was a tough, adhesive clay, kept wet throughout, and which it was equally difficult to get on the shovels, and to get rid of. Some years after, another pit was uncovered on the same bed, and under like circumstances, except that the time was the last of summer, and there was less water oozing through the earth. This digging was begun at the lowest part of the earth, which was a layer of sand, kept quite wet and soft by the water oozing through it. With gravel shovels, this was easily cut under from one to two feet along the whole length of the old pit, and, as fast as was desirable, the upper earth, thus undermined, fell into the old pit; and afterwards, when that did not take place of itself, the fallen earth was easily thrown there by shovels. As the earth fell separated into small but compact masses, it was not much affected by the water, even when it remained through the night before being shoveled away. No digging was required, except this continued shoveling out of the lowest sand stratum; and whether clay, or stones, or roots, were mixed with the falling earth, they were easy to throw off. The numerous roots, which were so troublesome in the former operation, were now an advantage; as they supported the earth sufficiently to let it fall only gradually and safely; and before the roots fell, they were almost clear of earth. The whole body of earth, notwithstanding all its difficulties, was moved off as easily as the driest and softest could have been by digging altogether.

In working a pit of wet marl, no pains should be spared to drain it as effectually as possible. Very few beds are penetrated by veins of running water which would deserve the name of springs; but water oozes very slowly through every part of wet marl, and bold springs often burst out immediately over its surface. After the form of the pit and situation of the road are determined, a ditch to receive and draw off all the water should be commenced down the valley, as low as the bottom of the area where the carts are to stand is expected to be made; and the ditch opened up to the work, deepening as it extends, so as to keep the bottom of the ditch on the same level with the bottom of the area. It may be cheaper, and will serve as well, to deepen this ditch as the deepening of the pit proceeds. After the marl is uncovered for the full size intended for the area, (which ought to be large enough for carts to turn about on,) a little drain of four or five inches wide, and as many deep, (or the size made by the grubbing hoe used to cut it,) should be carried all around to intercept the surface or spring water, and conduct it to the main drain. The marl will now be dry enough for the carts to be brought on and loaded. But as the digging proceeds, oozing water will collect slowly; and, aided by the wheels of loaded carts, the surface of the firmest marl would soon be rendered a puddle, and next quagmire. This may easily be prevented by the inclination of the surface. The first course dug off should be much the deepest next the surface drain, (leaving a margin of a few inches of firm marl, as a bank to keep in the stream,) so that the digging shall be the lowest around the outside, and gradually rise in level to the middle of the area. Whatever water may find its way within the work, whether from oozing, rain, or accidental burstings of the little surface drain, will run to the outside, the dip of which should lead to the lower main drain. After this form has once been given to the surface of the area, very little attention is required to preserve it; for if the successive courses are dug of equal depth from side to side, the previous dip will not be altered. The sides or walls of the pit should be cut, (in descending,) something without the perpendicular, so that the pit is made one or two feet wider at bottom than top. The usual firm texture will prevent any danger from this overhanging shape, and several advantages will be gained from it. It gives more space for work—prevents the wheels running on the lowest and wettest parts—allows more earth to the disposed of, in opening for the next pit—and prevents that earth from tumbling into the next digging, when the separating wall of marl is afterwards cut away. The next upper and larger drain of the pit, which takes the surface water, will hang over the small one below, kept for the oozing water. The former remains unaltered throughout the job, and may still convey the stream when six feet above the heads of the laborers in the pit. The lower drain of course sinks with the digging. Should the pit be dug deeper than the level of the main receiving ditch can be sunk, a wall should be left between, and the remainder of the oozing water must be conducted to a little basin near the wall, and thence be baled or pumped into the receiving ditch. The passage for the carts to ascend from the pit should be kept on a suitable slope; and the marl forming that slope may be cut out in small pits, after all the balance of the digging has been completed.

If the marl is so situated that carts cannot be driven as low as the bottom, either because of the danger of flooding, or that the ascent would be too steep for sufficiently easy draught, then the area must be cut out in small pits, as before stated, beginning at the back part, and extending as they proceed, towards the road leading out of the pit.

On high and hilly land, marl is generally found at the bottom of ra-

vines, and separated from the field to which it is to be carried by a high and steep hill-side. The difficulty of cutting roads in such situations is much less than any inexperienced person would suppose. We cannot get rid of any of the actual elevation—but the ascent may be made as gradual as is desired, by a proper location of the road. The intended course must be laid off by the eye, and the upper side of the road marked. If it passes through woods, it will be necessary to use grubbing hoes for the digging. With these, the digging should be begun at the distance of four or five feet below the marked line, and carried horizontally onward to it. The earth so dug is to be pulled back with broad hoes, and laid over a width of three or four feet below the place from which it was taken. Thus the upper side of the road is formed by cutting down, and the lower side by filling up with the earth taken from above.



The annexed figure will prevent these directions being misunderstood. The straight line from *a* to *b* represents the original slope of the hill-side, of which the whole figure is a section. The upper end of the dotted part of the line is in the mark for laying off the upper side of the road. The upper triangle is a section of the earth dug out of the hill-side, and the lower triangle of the part filled up by its removal. The horizontal line is the level of the road formed by cutting in on the upper, and filling up on the lower side. After shaping the road roughly, the deficiencies will be seen, and may be corrected in the finishing work, by deepening some places and filling up others, so as to graduate the whole properly. A width of eight or nine feet of firm road will be sufficient for carting marl.

If the land through which the road is to be cut is not very steep, and is free from trees and roots, the operation may be made much cheaper by using the plough. The first furrow should be run along the line of the lower side of the intended road, and turned down hill; the plough then returns empty, to carry a second furrow by the first. In this manner it proceeds, cutting deeply, and throwing the slices far, (both of which are easily done on a hill-side,) until rather more than the required width is ploughed. The ploughman then begins again over his first furrow, and ploughs the whole over as at first, and this course is repeated perhaps once or twice more, until enough earth is cut from the upper and put on the lower side of the road. After the first ploughing, broad hoes should aid and complete the work, by pulling down the earth from the higher to the lower side, and particularly in those places where the hill-side is steepest. After the proper shape is given, carts, at first empty and then with light loads, should be driven over every part of the surface of the road, until it is firm. If a heavy rain should fall before it has been thus trodden, the road would be rendered useless for a considerable time.

These directions are mostly suited for greater difficulties than usually occur, though they are such as attended most of my labors in marling. In the

great majority of cases, there will be much less labor and care and skill required, because there will not be encountered such obstacles as high and steep hills to ascend, thick over-lying earth to remove, or wet pits and roads to keep drained.

In large operations and in dry marl, much labor of digging might be saved by slightly undermining a perpendicular body of marl, and then splitting of large masses at once, by driving in a line of wedges on the upper surface.

For hard or firm marl, narrow and heavy picks are the best digging utensils. Gravel shovels, with rounded points and long handles, are the cheapest and most effective for throwing out the marl and loading the carts, as well as for afterwards spreading the heaps on the field.

Tumbrel carts, drawn by a single horse or mule, are most convenient for conveying marl short distances. Every part of the cart should be light, and the body should be so small as only to hold the load it is intended to carry, without a tail-board. This plan enables the drivers to measure every load, which advantage will be found on trial much more important than would at first be supposed. If carts of common size are used, the careless laborers will generally load too lightly, yet sometimes will injure the horse by putting on a load much too heavy. The small sized cart-bodies prevent both these faults. The load cannot be made much too heavy; and if too light, the farmer can detect it at a glance. Where there is a hill to ascend, five heaped bushels of wet marl is a sufficient load for a horse or good mule. If the marl is dry, or the road level and firm, six bushels will be not too much, and may be put in the same carts, by using tail-boards.

Strong laborers are required in the pit for digging and loading; but boys who are too small for any other regular farm labor, are sufficient to drive the carts. Horses or mules kept at this work soon become so tractable that very little strength or skill is required to drive them.

One of the most general and injurious errors is the irregular and unequal distribution of the marl over the fields. By this error, it often happens that in the same acre there is both too much and too little marl, on many different parts. It will save much time and trouble, and ensure far greater accuracy in depositing the loads, and afterwards in spreading them, to have the field marked off slightly by a plough, in checks or squares of sizes suitable to the desired amount of the dressing. A load (or the half of a load for very light marling) should be dropped in every square, and the heap be required to be spread over that marked space precisely.

All these hints and expedients, or perhaps better plans, might perhaps occur to most persons before they are long engaged in marling. Still these directions may help to smooth away some of the obstructions in the way of the inexperienced; and they will not be entirely useless, if they serve to prevent even small losses of time and labor.

CHAPTER XVII.

THE PROGRESS OF MARLING IN VIRGINIA.

My task is at last completed. Whether I shall be able to persuade my countrymen to prize the treasures, and seize the profits which are within their reach, or whether my testimony and arguments shall be fruitless, soon or late, a time must arrive when my expectations will be realized. The use of calcareous manures is destined to change a large portion of the soil of lower Virginia from barrenness to fertility; which, added to the advantages we already possess—our navigable waters and convenient markets, the facility of tilling our lands, and the choice of crops offered by our climate—will all concur to increase ten-fold the present value of our land, and produce more farming profit than has been found elsewhere on soils far more favored by nature. Population, wealth and learning, will keep pace with the improvement of the soil; and we or our children will have reason to rejoice, not only as farmers, but as Virginians, and as patriots.

Such, as appear in the last paragraph, were the concluding words of this essay, as published in 1832, and precisely as the work had been prepared for the press several years before that publication was made. Such was then the language of hope and anticipation. It may now be both interesting and useful to examine to what extent such hopes and sanguine anticipations have been yet realized.

Every new and great improvement in agriculture has had to work its way slowly and in opposition to every possible discouragement and obstacle. It would seem that the agricultural classes were, of all classes and professions, always the least ready to receive benefit from instruction—the most distrustful of instructers and the least thankful for their services—even after the benefit is the most completely proved, and established by actual practice and unquestionable facts. The novel improvement by marling has not been an exception to this universal rule. But still, it may be confidently asserted, that no other agricultural improvement has been so rapidly extended, so widely and generally received in such short time, or has been so generally and greatly profitable to all who have availed themselves of the benefits thereby offered to their acceptance. When my first trials were made in 1818, so far as I then knew, I had no forerunner in success. For the few and small known and long abandoned experiments, and the opinions deduced therefrom, stood as warnings against, and not in the least as inducements to repetition; and the then actually proceeding use of marl, silent and unknown, but successful, had not even been heard of. A few more years served to dispel all doubts of those who had tried or could witness the results of the applications of marl. Still, ignorance of the mode of operation has not been dispelled by the knowledge of the great benefits of marl; and therefore the grossest errors of practice accompanied and greatly lessened the full advantages of the continually extending use of marl. It required but little time for all to learn and submit to the one main and simple instruction, "apply marl;" but few would consent to learn any thing else, or would believe that there was any thing else necessary to learn or to do, except merely to "apply marl." They would not learn from any thing but their own dearly bought experience of error. And very many have thus learned, and have paid the cost to their own pecuniary interest of thousands of dollars in value—whether of delay, of

misapplied effort, or of positive loss and injury sustained by wrong practice—which the out-lay of a few shillings, and the attentive reading for a few hours, might have effectually guarded them against. And so it still goes on, and will go on, with all who are new beginners and learners, and who have not yet paid each their hundreds or thousands of dollars in loss, in preference to less than as many cents, in both money and labor, in acquiring proper instruction, and security from all such loss.

But with all such enormous drawbacks of loss, which if avoided would have doubled the actually achieved benefits, the extension of marling and liming, and the amount of benefit thence derived and realized in lower Virginia, since 1818, have had no precedent in the annals of agricultural improvement by any mode of manuring. The following extract from a more general report, recently made by the writer to the State Board of Agriculture, will present this branch of the subject in its proper aspect.

"*Marling, or manuring from beds of fossil shells.*—This mode of fertilization, now so general through all the marl region of lower Virginia, was not practised except on three or four detached farms, and that to but small extent before 1820. Some few and generally small experimental applications of marl had indeed been made by different individuals, from 15 to as far back as 45 years before; but which applications, from total misconception of the true mode of action of calcareous manures, had been deemed failures; and without exception, of course, had been abandoned by the experimenters as worthless; and the experiments had been almost forgotten, until again brought to notice, after the much later and fully successful introduction of the practice.

"Henley Taylor and Archer Hankins, two plain and illiterate farmers, and near neighbors in James City county, were the earliest *successful* and continuing appliers of marl in Virginia. But at what time they began, and which of them was the first, I have not been able to learn, though visiting Mr. Hankins' farm for that purpose, as well as to see his marling, and making inquiries of him personally, in 1833. Mr. Taylor had then been long dead, and his improvements said to be almost lost, by the then occupant of his land. Mr. Hankins was unable to say when he and his neighbor began to try marl. He was only certain that it was before 1816. Yet, though these farms are within 12 or 15 miles of Williamsburg, to which place I had made visits once a year or oftener, yet I never heard an intimation of their having begun such practice, until some time after my own first trials in 1818. At that time, when led to the use, as I was, altogether by theoretical views, and by reasoning on the supposed constitution of the soil, as well as the known constitution of the manure, it would have been to me the most acceptable and beneficial information to have heard that any other person in Virginia had already proved practically the value of marling. The slow progress of the knowledge of the mere fact of marl having been successfully used before that time, was a strong illustration of the then almost total want of communication among farmers, as well as of their general apathy and ignorance, in regard to the means of improving their lands.*

"Much earlier than the commencement of marling in James City, the practice had been commenced, (in 1805,) in Talbot county, Maryland, by Mr. Singleton. His account of his practice is in the 4th volume of the 'Memoirs of the Philadelphia Agricultural Society,' dated December 31, 1817, and first published some time in 1818. But successful as was his

* See a more full account at page 108, vol. i., Farmers' Register.

practice, and also that of Mr. Taylor and Mr. Hankins, in connexion with much worse farming, it is certain that neither of these individuals had the least idea of the true action of marl; and they were indebted to their good fortune, more than to any exercise of reasoning, that they received profitable returns, and did no injury by marling. They all three applied their putrescent manures with the marl. But though this was the safest and most beneficial plan, the thus uniting them prevented the separate action and value of putrescent and calcareous manures being known, compared, and duly appreciated.

"My own application of marl, on Coggins Point farm, Prince George county, which in 1818 extended only to 15 acres, (of which but 3 or 4 were under the crop of that year,) by 1821 had been increased to above 80 acres a year, and so continued until nearly all the then arable land on that farm requiring it, (more than 600 acres,) had been covered. In 1821, my earliest publication on the subject was made. Though the facts and reasoning thus made known by that time were beginning to attract much notice, and to induce many persons to begin to marl, still it was some years later before incredulity and ridicule had generally given place to full confidence in the value of the improvement. Even at this time, when nearly 25 years of my own experience of marling and its benefits have passed, and the results are open to public notice and scrutiny, not half the persons who could marl are engaged at it, or are marling to but little purpose; and of all who are using marl, nineteen in twenty are proceeding injudiciously, without regard to the mode of operation of the manure, and therefore are either doing harm, or losing profit, almost as often, though in less degree, as doing good. At this time, however, there are scarcely any persons, however negligent in practice, who do not fully admit the great value and certain profit of applying marl wherever it is found.

"But with all the existing neglect of using this means of fertilization, and with all the still worse ignorance of or inattention to its manner of operating, there never has been a new improvement in agriculture more rapidly extended, or with such beneficial and profitable results. In Prince George county, there is not one farmer having marl on or near his land, who has not applied it to greater or less extent, and always with more or less profit—and, in most cases, largely as well as profitably. In James City county there has been perhaps the next largest as well as the oldest practice. In York county, as in James City, some of the most valuable and profitable improvements by marling have been made. And some of the farms of both counties, adjoining Williamsburg, and having the benefit of putrescent town manures, show, more strikingly than any others known, the remarkable power of calcareous manure to fix the putrescent in the soil, and make them more efficient and far more durable. In Surry, Isle of Wight, Nansemond, Charles City, New Kent, Hanover, King William, King and Queen, Gloucester, and Middlesex counties, in the middle of the marl region of Virginia, marl has been already extensively applied, and the profits therefrom are annually increasing. And in other surrounding counties, worse supplied with marl, the practice has been carried on in proportion to the facilities, and to the more scanty experience and degree of information on the subject. It would be a most important statistical fact, if it could be ascertained how much land in Virginia has already been marled. The quantity however is very great; and all the land marled has been thereby increased in *net* product, on the general average, fully 8 bushels of corn or oats, or 4 bushels of wheat—and the land increased in intrinsic value fully 200 per cent. on its previous value or market price. Where the marling has been judiciously conducted, these rates of increase have been more

than doubled. From these data, might be calculated something like the already prodigiously increased values and products due solely to marling, and which will be still more increasing from year to year. If not already reached, the result *will* soon be reached, of new value to the amount of millions of dollars having been thus created. It is not designed in this hasty sketch to enter into minute details of results, nor to prescribe rules for practice, both of which have been given in other publications. The purpose here is but to state improvements and describe results in general.

"It required the improvement by marling, on originally poor and middling soils, (or liming, which in final or general results is the same thing,) to render as generally available the best and otherwise but rarely found benefits of the two kinds of vegetable manuring recommended by Taylor. When such soils have been made calcareous, by marling or liming, then, and not until then, all the benefits present and future, that his readers might have been induced to expect, may be confidently counted upon. In my own earlier practice—and Taylor had no greater admirer, or more implicit follower—I found my farm-yard manurings on acid soils scarcely to pay the expense of application, and to leave no trace of the effect after a very short time. And land, allowed to receive for its support all its vegetable growth (of weeds and natural grass) of two and a half years in every four, and the products in corn having been measured and compared, showed no certain increase in more than twenty years of such mild treatment. Since, on the same fields, farm-yard manures, in every mode of preparation and application, always tell well, both in early effect and in duration. And even the leaves raked up on wood-land, spread immediately and without any preparation as top-dressing on clover, always produce most manifest improvement, and are believed to give more *net* profit than any application of the much richer farm-yard manure, per acre, made on like land before it is marled. This utilizing and fixing of other manures, and the fitting land to produce clover, which effects of marling are in addition to all the *direct* benefit produced, would alone serve to give a new face to the agriculture of the country. Whatever may be done by clover, and almost every thing that can be done to profit by vegetable manures, on the much larger proportion of the lands of lower Virginia, will be due to the application of marl or lime.

"*Liming.*—The kindred improvement by liming began to be extensively practised on some of the best James river lands, where no marl was found, soon after the use of the latter began to extend. Who may have made the earliest and small applications of lime is not known, nor is it at all important. The earlier profitable use of lime in Pennsylvania, and the much earlier and more extended use in Britain, were known to every well-informed or reading farmer. Such a one was Fielding Lewis, of Charles City, as well as a most attentive, judicious, and successful practical cultivator and improver. He is believed to have been the earliest considerable limer, and the one who obtained the most manifest profits therefrom, and whose example had most effect in spreading the practice. Some of his disciples and followers have since, in greater rapidity and wider extent of operations, far surpassed their teacher and leader—to whom, however, they award the highest meed of praise for bringing into use, and establishing, this great benefit to the agriculture of lower Virginia. Nearly all the best soils on James river are comparatively of low level, as if of ancient alluvial formation, and have no marl, with which the neighboring higher and poorer lands are mostly supplied. Of such rich lands are the farms of Weyanoke, Sandy Point, Westover, and Shirley, &c., in Charles City, and Brandon (Upper and Lower,) in Prince George—and on all these lands, as well as

some others, lime has been largely applied. The use is extending to the lands on all the tide waters of the state; and it has recently received a new impulse from the low price at which northern stone-lime is now brought and sold. It is ready slaked, and the vessels are loaded in bulk. The lime is sold on James river at 10 cents the bushel, and even may be contracted for at 8 cents, from vessels that come for cargoes of wood, and would come empty but for bringing lime. The greater lightness and cheaper transportation of lime will enable it to be applied where marl could not be carried with profit; and with the two, there will be but little of lower Virginia which may not be profitably improved by calcareous manures."*

* Extract from "Report to the State Board of Agriculture, on the most important recent improvements of agriculture in lower Virginia, and the most important defects yet remaining," Farmers' Register, p. 257, vol. x.

AN

ESSAY

ON

CALCAREOUS MANURES.

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PART THIRD—APPENDIX.

INTRODUCTORY REMARKS.

In the foregoing exposition of theory and practice, it has been the object and effort of the author to embrace whatever seemed necessary for proof or for illustration; and to omit every thing else, lest too much of amplification or digression should weaken rather than strengthen the main positions. Thus it is believed that the foregoing chapters, as argument and proof, serve to establish the series of propositions which were at first advanced and throughout contended for. Still there remained many minor but interesting subjects more or less intimately connected with the investigation, and which well deserved more extended discussion, and the consideration of those readers who should desire to pursue farther the general object of this essay. These subjects will be treated separately in the different articles of this appendix; which may be read, it is believed, with both interest and benefit by the more inquiring class of readers; or may be passed over, by the more cursory and careless, without detriment to the arguments and facts of the preceding portion and regular body of the work.

Among the most important of the subjects to be thus treated at length, will be the remarkable and extensive deposites of gypseous earth, or greensand earth, in lower Virginia, and its action as manure—the formation of prairies, (or lands divested of trees)—and the causes of, and remedies for malaria, and its train of diseases, which serve, aided by the operation of the evil legislative policy of Virginia, so grievously to afflict this now otherwise most fortunate and highly blessed agricultural region. Various other articles will be presented, which will be but extensions of different parts of the foregoing text, and which will serve as additional proofs or illustrations of some of the positions before presented and maintained.

NOTE I.—*Extension of subject at page 54.*

PROOFS OF THE EXISTENCE OF ACID SOILS, FURNISHED BY THE RECENT RESEARCHES OF CHEMISTS.

The '*Traité de Chimie*' is a French translation, by Esslinger, of the voluminous and valuable work of the great Swedish chemist, Berzelius. The first edition of the original work, in the German language, and the French

translation of it were in the course of publication at the same time; and the first volumes of the latter were published at Paris, before the latter volumes of the original work had been sent to the press at Stockholm. The sixth volume of the French translation, from which I have translated the following extract into English, was printed in 1832. It is not known to me whether the original work is in this country [1835.]

The following passages contain the opinions of Berzelius, and of other chemists, on humin and humic acids, or as called here, *geine* and *geic acid*, and which were referred to in the quotation from Rennie, at page 54. It will be left to the reader to decide how far my views of acid soils are supported by these new opinions of chemists, founded upon chemical analyses of the substances in question. It is proper to state that this new doctrine of geic or humic acid has not passed uncontroverted. It is altogether denied by Raspail, a French chemist, and who is a later writer than Berzelius.

This article will offer scarcely any thing of interest to most readers, and is one of those which will be generally passed over. Its substance might indeed have been given more concisely, and perhaps in a more attractive form, if my object had been merely to exhibit the opinions now generally received among scientific men concerning acid in soil. But it was also designed to exhibit what was the utmost possible extent of scientific authority for this doctrine, so far as could have been known in this country when the last preceding edition of this essay was published in 1835. When my still earlier editions asserted the same doctrine, as then and now, there was not only no scientific authority for acid in soil, but all authority was opposed, either directly or indirectly.

[TRANSLATION.]

Products of putrefaction at the surface of the earth.

Mould (*terreau.*)—The vegetable matters which rot at the surface of the earth, finish by leaving a blackish brown pulverulent mass, which has received the name of *mould* [humus.]

All the vegetation of a year, which dies at the arrival of winter, is converted by degrees to mould, which is mixed with the earth in which the plant grew; whence it comes that the extreme surface of the earth contains a greater or less proportion of mould, which serves for the nutriment of the succeeding growth of plants. This mould, such as it is found in the earth, is often mingled with the products of a less advanced putrefaction, or even with vegetable parts not changed, principally a great quantity of small roots. If we examine the mould, such as it is found in cultivated soils, it is found to be in a mass very much mixed; but it is always possible to extract the parts which characterize mould.

During the transformation of the vegetable matters to mould, the first portion of their mass is changed into a brownish black substance, which presents all the characters of *apotheme** when we have separated from it the unaltered *extract*, which the apotheme draws with it. The salts of such acids as are of organic origin, contained in the vegetable matter, are destroyed, so that the elements of the acid are resolved into water and carbonic acid, whilst the base is combined with the substance analogous

* What Berzelius calls apotheme is "a deposite slightly soluble in water, produced in an aqueous solution of vegetable extract during slow evaporation, and containing a larger proportion of carbon, than does an equal weight of extract."

to apotheme, which makes part of the mould. The salts of acids of mineral origin are preserved, unless they are soluble, in which case the rain carries them off. In addition, mould contains a substance but slightly soluble in water, which colors the liquid yellow, and a carbonaceous substance which is entirely insoluble, and which appears to be one of the products of a destruction, still more advanced, of organic matters.

To give an example of a completed formation of a mould of vegetable origin, I shall here state the results of an analysis to which Braconnot submitted some wheat, which had remained during many centuries in a damp vault, the issues from which were stopped up by earth, and of which the existence was forgotten, until by chance it was again discovered. The grains had preserved their form, and the brightness of their outside skin; but they were black, and were reduced by the slightest pressure to a black powder. The water with which they were boiled was colored yellow, and it left, after being evaporated, a saline mass of a brownish yellow, which burnt with slight explosion when heated, and which, besides the substance cited soluble in water, contained nitrate of potash, nitrate of lime, and a little of the muriates of potash and of lime. The nitrates were the result of the oxidation of the nitrogen contained in the gluten and vegetable albumen, and of the combination of the nitric acid thus produced, with the bases previously combined with vegetable acids. The weight of this mass soluble in water, including the salts and all the other principles, did not exceed $1\frac{1}{2}$ per cent. of the weight of the black grain. When the part insoluble in water was boiled in alcohol, a small trace of a brown substance was taken up, which remained after evaporating the alcohol, and had the consistence of wax. The mass, exhausted of its soluble parts by boiling water and alcohol, was then heated slowly with a weak solution of caustic potash, which became saturated and colored of a blackish brown; and this treatment was continued as long as new potash lie took up any thing. This substance was precipitated from the solution by an acid; it was the body similar to *apotheme* which has already been mentioned, and of which the weight amounted to $26\frac{1}{2}$ per cent. The portion of matter insoluble in the alkali preserved the same appearance. This, exposed to the action of diluted muriatic acid, yielded to it a certain quantity of lime, of oxide of iron, and of phosphate of lime. The residue was again acted on by potash, which took up a new and very large proportion of the body similar to *apotheme*. This was after that combined with lime, and resisted in that state the action of potash. This calcareous combination amounted to 42 hundredths. The 30 per cent. remaining consisted of a black carbonaceous matter, insoluble in the solvent used.

If cultivated soil is treated in the same manner, similar results will be obtained, with this difference, that the earthy matter of the soil is found mixed with the products which are obtained, whilst no soluble salts are met with, they being generally carried off by the rains.

To describe the constituent principles of mould, it is necessary to designate them by particular names. I will then call *extract af mould* the body soluble in water, and I will give the name of *geine** to the matter similar to apotheme, which constitutes the principal mass of mould. As to the coally substance insoluble in water, alcohol, acids and alkalies, I will designate it by the name of *carbonaceous* mould.

Extract of mould.—We obtain this substance by drawing it from the mould by the action of cold water, which becomes thereby colored yellow, and which leaves, after evaporation, a yellow extract of a bitter taste, and

* Or *humin*, as termed by other authors.

from which some geine is separated when it is again acted on by water. If this solution is left to evaporate spontaneously in contact with air, it becomes covered with an insoluble pellicle, and when a certain degree of concentration has been reached, the liquor becomes turbid. The solution is precipitated by the salts of tin and of lead; after the precipitation, the liquor is without color. According to Korte, the sulphuretted hydrogen gas precipitates it also. This extractive matter is contained in the water of many springs and streams. The water of the springs of Porla, in Westrogotha, contains so great a quantity that it is colored yellow. When the iron contained in this water is oxidized from the air, the extract of mould is precipitated with the oxide of iron, and the water becomes clear.

Geine.—This substance has received different names. Braconnot has given to it the name of *ulmin*, for reasons which I have exhibited and opposed in a former part of this work. Dobereiner and Sprengel gave to it the name of *acid of humus*, because it combines with the earths and alkalies. But for the same reason we might give the name of *acid* to more than the half of all vegetable bodies.

Geine does not exist in vegetable earth only; soot contains it also, and according to Braconnot, it is formed when the saw-dust of wood is exposed to the action of caustic potash. It is almost impossible to obtain geine in a state of purity. One part of geine which is met with in a natural state is in combination with bases; but when we attempt to remove these by an acid, the geine combines in part with the excess of acid, and acquires itself (in part) the property of reddening vegetable blues. Geine possesses all the properties of apotheme, and it is produced like other apothemes; that is to say, by the action of the air on dissolved extract of mould. In the natural state it does not act chemically, either like the acids or the alkalies. Nor does it have any effect on the color of vegetable blues. It is but slightly soluble in water, which it colors of a pale yellow; is still less soluble in alcohol, and insoluble in ether. Exposed to the action of heat it takes fire, burns at first with flame, then without flame like spunk, spreading a peculiar odor, something like that of burning peat. Submitted to dry distillation, it is decomposed, gives half its weight of a charcoal having a metallic lustre, of empyreumatic oil, an acid water containing acetic acid and sometimes ammonia, some carburetted hydrogen, and a little carbonic acid gas. If geine is held suspended in water, through which a current of chlorine is passed, this whitens it, and precipitates a white resin-like substance. Iodine is without action on it. If we add an acid to an alkaline solution of geine, the geine is precipitated. If the whole of the geine is not precipitated, that part which is precipitated retains in combination a small portion of the base, and leaves, when it is burnt, a small quantity of alkaline ashes. If, on the contrary, an excess of acid is poured into the alkaline solution, the liquor is discolored, and the precipitated geine strongly reddens vegetable blues, a property which cannot be removed by placing the geine on a filter, and pouring water upon it. So long as the liquor which passes through the filter contains free acid it is not colored; then it begins to be colored, and finally it dissolves as much as two-thirds of its weight of the precipitated mass. These acid properties belong in part to the geine, which owes them to the action of the alkali, and which may, in this case, be called *geic acid;* they ought to be in part attributed to a combination of the geine with the precipitated acid. According to Einhoff, it is the latter case which is really presented, and the acid cannot be carried off, but with the aid of an alkali. Sprengel, on the other hand, pretends to have freed the geine, by prolonged washing, from the muriatic acid which had served to precipitate it: and to make certain the absence of the

muriatic acid, he has mixed the washed geine with a little nitrate of silver. After evaporation to dryness, and calcination, the residue, treated by nitric acid, was dissolved, without leaving any muriate of silver. But as muriate of silver, like the other salts of silver, is reduced to a metallic state by bodies containing carbon and hydrogen, and carbon itself effects the same change when disengaged along with water, this result proves nothing. In general, in the descriptions of geine, they have attributed the properties of that which has been changed by the action of an alkali, to the geine which has not been altered. The geine which reddens vegetable blues, is the same, whatever may have been the acid which served for its precipitation. Its saturated aqueous solution is of a yellowish brown, and the combination is precipitated anew by acids, excepting the carbonic, and the sulphuretted hydrogen. Collected upon a filter, it is presented under the form of a gelatinous mass, of a taste slightly acid, astringent—and by drying, it contracts strongly, and forms clots of a deep brown, almost black, with a vitreous fracture, and which are not dissolved again in water after being once completely dried. The aqueous solution of the acid geine, is precipitated by the salts of lead, of tin, and of iron; but is not disturbed by gelatine, albumen, starch, gum, tannin, or solution of soap. According to Braconnot, it is precipitated by a mixture of the solution of gelatine and gallic acid. The dried geine is dissolved with difficulty, and incompletely, in alcohol. The solution reddens vegetable blues, whilst the part not dissolved is without this power, though it still preserves the property of combining with potash. Geine is destroyed by concentrated acids. The sulphuric acid dissolves it, taking at the same time a black color, carbonizing it, disengaging sulphurous acid gas, and leaving for residue the ordinary products which result from the action of this acid. By the addition of suroxide (or black oxide) of manganese, carbonic acid gas is disengaged. The nitric acid dissolves and decomposes geine, with a disengagement of nitric oxide gas, and carbonic acid gas. If the solution is evaporated to the consistence of syrup, and then mixed with water, there is precipitated a peculiar bitter substance in powder, and there are found in the solution, artificial tannin and oxalic acid.

Geine forms soluble combinations with alkalies. When an excess of geine is used, the caustic alkalies are so neutralized by this substance, that they lose their peculiar chemical action and properties. In this respect, geine agrees with gluten, vegetable albumen, the brown of indigo, the sugar of liquorice, apotheme, and other bodies not acid. During the evaporation the solution furnishes a black mass, which acquires lustre by complete drying, and splits, and is easily reduced to a powder. It is redissolved in water, its taste is weak, bitter and disagreeable. Caustic ammonia gives a like mass, soluble in water, which gives up, during evaporation, the excess of alkali employed. Geine is not dissolved always in alkaline carbonates; when it is so dissolved, these carbonates are transformed, half into *geates*, half into bi-carbonates. When the solution is boiled, the bi-carbonate is decomposed with disengagement of carbonic acid gas, and in this manner the geine drives off all the carbonic acid. If a solution of geine in carbonate of ammonia is evaporated, a residue is obtained containing neutralized geate of ammonia. The solution of geine in caustic potash, in excess, absorbs oxygen from the air, and at the end of some time, the alkali is in part carbonated.

Geine forms with the *alkaline earths* pulverulent combinations but little soluble, which have an external resemblance to geine. The best means for obtaining them is to mix a solution of the geate of ammonia, with the solu-

tion of an earthy salt; the combination of the geine with the earth is precipitated, and may be separated by filtration, from the supernatant fluid. In the humid state, these compounds are slightly soluble in water. According to the experiments of Sprengel, one part of *geate of barytes* is dissolved in 5200 parts of water, one part of geate of lime is soluble in 2000 parts of water, and one part of geate of magnesia in 160 parts of water, cold. These same compounds require for their solution, rather smaller proportions of boiling water. After having been completely dried they will no more dissolve. In the air, the base is combined in part with carbonic acid, and the carbonate which results therefrom remains in the state of mixture with a combination of geine, and of a base analogous to a supersalt. The alkaline carbonates decompose the earthy geates; they dissolve the geine, and leave the base in the state of carbonate. According to Sprengel, the *geates of lime* and *magnesia* are dissolved in the caustic fixed alkalies, and in the carbonate of ammonia. Other chemists have not arrived at the same result; and according to them, the geate of potash, acted on by the hydrate of lime, precipitates all the geine. The *geate of alumina* is precipitated when a solution of alum is mixed with a solution of geate of potash, or of ammonia. This compound is dissolved in 4200 parts of cold water. In the moist state it is dissolved easily, and in abundance, in the alkaline carbonates and hydrates, and even in ammonia. According to Sprengel, it resists the decomposing action of acids, so that it is difficult to extract from it geine exempt from alumine. A combination is obtained having an excess of alumine, by digesting a solution of the geate of ammonia with hydrate of alumina. * * * *

Carbonaceous mould.—The substance to which this name has been given has been but little examined. It is insoluble in alkaline liquors. Its color is a brown, almost black. Placed in contact with a body in combustion, it takes fire, and burns without flame like spunk. According to the experiments of Th. de Saussure, carbonaceous mould combines with the oxygen of the air, and forms carbonic acid gas, and when it is left a long time exposed to air and water, it becomes by slow degrees soluble in alkalies. The acids precipitate it from the alkaline solution, in the state of acid geine. When cold, the sulphuric acid has but little effect on it. According to Braconnot, the nitric acid converts it at a gentle heat to a brown liquor, in which water produces a precipitate of a chocolate color, which possesses the properties of acid geine, and is dissolved without residue in the alkalies.

Soil (*terre végétale*).—It is the mixture of these several substances with the upper layer of the surface of the earth, which constitutes the *vegetable earth* or *soil*, properly so called. Arable land is a bed of this soil, placed upon a bed of earth which contains no mould. Its fertility depends upon the quantity of mould which it contains. Growing plants continually diminish the quantity of geine contained in the soil; and when the plants are carried off from the soil on which they grew, which happens almost always with cultivated land, it is finally exhausted to that degree as to produce nothing. It is on this account that it is necessary to manure land. The matters discharged and left by animals, or the barn-yard manure which is used for this purpose, are by degrees converted into geine, and thus replace the matters dissipated by vegetation. Botanists, who have directed their attention to vegetable physiology, have remarked that the plants vegetate well enough without geine, until the time arrives for them to commence their sexual functions. But as soon as these are ended and the fruit begins to be developed, the plants absorb a great quantity of the

nutritive principles contained in the soil, and if these are not in the soil, the flower falls without forming any fruit. The experiments to which Th. de Saussure has submitted soil, [terre végétale] appear to demonstrate that the three constituent principles of mould may be converted the one to the other, under the alternately preponderating influence of air and water. Water converts to the *extract of mould* a part of the insoluble *geine* contained in the soil, and this transformation extends more and more, so that finally the greater part of the geine becomes soluble. In contact with the air, the dissolved matter passes again to the state of geine. The *carbonaceous mould* which changes a part of the air into carbonic acid, is itself changed by air into geine and into extract of mould, and it is upon this transformation that appear to depend in part the advantages derived from the tillage of the soil, which is divided by the action of the plough, and exposed to the immediate influence of the air. In this manner all the parts of the soil contribute to nutrition; whilst it is probable that the solution of the extract of mould, that of the geate of lime, and perhaps also that of the geate of alumine, are immediately absorbed by the roots. During a heavy rain, this solution penetrates the interior, and often to very deep beds of the sterile earth; but notwithstanding that, it is not lost to vegetable life; for the roots of trees seek it, and bring it back as matter suitable for their nourishment.

Experience has demonstrated that quick-lime and the carbonate of lime mingled with the soil, favor the vegetation produced thereon. Chemistry has not yet explained, in a satisfactory manner, the power which lime thus exerts; however, it is known that when the soil contains this alkaline earth, or, in its place, ashes only, the mould is quickly consumed, and vegetation becomes more rich in proportion. It has thence been concluded that lime acts, partly in exciting the plant to greater activity, and partly in rendering more soluble the principles of the soil, which are absorbed by the roots when dissolved in the water which the earth has imbibed. Lime is not then a true [or alimentary] manure. It contributes only to promote and hasten the absorption of the principles which serve to nourish the plant; and that lime may be serviceable, it is necessary to introduce into the soil improved by lime, materials proper to furnish new quantities of mould. The lime or alkali contained in ashes acts also in hastening the change of organic matters to mould.

It is known by experience, that gypsum also augments the fertility of the earth, especially when leguminous plants are cultivated. It is not probable that this neutral salt acts in the same manner as lime, and we are ignorant of what is its mode of acting.

Soil [*terre végétale*] possesses the property of being able to retain as much as three-fourths of its weight of water without appearing moist, and, like charcoal, it condenses atmospheric humidity. It owes this property to the geine which it contains, which is one of the substances that, of all known, absorbs moisture with most energy. Mould [*terreau*] can absorb double its weight of water, without appearing moist; and after being dried, it draws from the air, in less than twenty-four hours, a quantity of water, which may vary according to the humidity of the atmosphere, from 80 to 100 per cent. of its weight. This property depends upon its light and dust-like consistence; and geine, of which the fracture becomes vitreous from its course of chemical treatment, is deprived of this physical property, which is of the utmost importance to vegetable life. For, in consequence of this property, mould retains water in the earth and obstructs its evaporation; and it is probably this water which maintains the extremities of the roots in the state to perform their functions.

It is usual to divide soil into fertile earth, and acid earth.* The first is very common, the second presents itself but rarely. It produces nothing, unless it be mosses; it is in marshy places that it is ordinarily found. It is in general composed in the same manner as fertile earth; but whilst in the latter the geine is united with lime, and perhaps with other bases besides, it is in the acid earth combined with acids, which, according to Einhof, are the phosphoric and acetic acids. It is for this reason that it has the property of reddening vegetable blues, and that it gives, by calcination, ashes which contain phosphoric acid. To dry distillation, it yields a great quantity of an acid liquid, containing the acetate of ammonia; and when it is distilled, after having mixed it with water, a liquid product is obtained, which reddens vegetable blues, and likewise contains acetate of ammonia. In opposition to Einhof, Sprengel affirms that the acid geine is produced only for the want of bases, and that its acid action proceeds only from the geic acid which it contains, and not from the presence of a foreign acid. De Pontin has made the analysis of an acid† soil taken from the plain of Eckerud, in the government of Elfsburg, in Sweden, and found that the geine had there combined with the malic, acetic, and phosphoric acids. The dissolving of the soluble principles of the soil in boiling water, left to be deposited when the hydrate of lime was mixed therein, these acids as well as geine, so that there was found afterwards in the water only traces of the acetate and hydrate of lime. But when a current of carbonic acid gas was made to pass through this precipitate, steeped in water, the geine remained, without dissolving, in combination with the carbonate of lime produced, while there was formed a solution slightly yellowish, which left after evaporation a residue of calcareous salts. This residue was treated by alcohol, which took up a certain quantity of acetate of lime, and left a salt of lime of a gummy appearance, which was soluble in water, and possessed the properties of the malate of lime. In burning the geate of lime, and taking up the residue by muriatic acid, there was obtained a solution which when treated by ammonia gave a small precipitate of phosphate of lime. The greater part of the acid geine was dissolved in the carbonate of ammonia. Hydrate of lime was poured into the solution, which precipitated the geine without leaving in solution a salt of lime. But when after having washed the precipitate, it was calcined, and the residue treated with muriatic acid, there was obtained a solution, which, after the expulsion of the carbonic acid, gave with ammonia an abundant precipitate of the phosphate of lime. These experiments confirm those given by Einhof.

An acid soil becomes fertile when there is mixed with it lime or ashes

* It is not a little strange to say it is "*usual* [*dans l'usage*] to divide soils into fertile earth and *acid* earth," when the acid nature of any has been treated by Berzelius as a new discovery, and of which the truth is not admitted by all of those who had taken the subject into consideration. If this division had indeed been usual, there would have been no want of numerous authorities (whatever might be their value) for the acidity of soil.—TRANSLATOR.

† In the French version, this word was "*aride*," and also in the two other places where it is used below soon after. But though the context made it almost certain that this was an error of the press, and that the word should have been *acide*, I did not venture to make the alteration in a preceding edition, but merely stated in a note, the doubt, and probable grounds of error. Very lately, (1842,) I saw for the first time the German work by Berzelius, in the library of Professor J. C. Booth of Philadelphia, and by aid of his knowledge of the language, I was enabled to make sure that the error was as I had supposed. Though the book lately examined was the second edition, the extract was translated (through the French) from Berzelius' first edition, and there is no difference in the above paragraph, except that in the latter he has added the term "unfruitful" to "acid soil," [*unfruchtbare saure Dammerde.*]—TRANSLATOR.

and earth, inasmuch as the soil consists principally of geine. The report of Sprengel, according to which, it [this character of soil] is produced in consequence of the absence of the bases which are found in fertile earth, is certainly true; but it does not follow from that, that it owes its acidity solely to the acid nature of the geine. The ashes of acid soil always contain a great quantity of silex.

NOTE II.—*Extension of subject of pages* 58—61.

ADDITIONAL PROOF OFFERED, BY THE PRODUCTION AND EXISTENCE OF BLACK WATERS, OF THE ACTION OF LIME IN COMBINING VEGETABLE MATTERS WITH SOIL.

Every person who has seen much of the different parts of lower Virginia, (to go no farther for examples,) must have remarked the dark permanent color of the waters of many streams and mill-ponds; and that others, whether when clear or when turbid, are at all times and entirely without any tinge of this peculiar coloring matter. The waters thus colored by vegetable matter are more deeply tinted at some times than at others; but are always strongly thus marked. These waters, when several feet in depth, appear to the eye quite black or very dark brown. The same if viewed in a drinking glass would appear of the color of Sherry wine, and might present some shade between the palest and deepest tints of such wine. This color has nothing of muddiness; for these waters are as clear from suspended clay or mud as any other waters not so colored in the slightest degree. In the county in which nearly all my life has been passed, Prince George, these different kinds of waters are to be seen in stronger contrast, because of their close neighborhood. All the streams which flow into Blackwater river, as well as the main stream, which that name so well describes, from its head to its outlet, are colored deeply, and it is believed without exception. On the contrary, the streams which flow into James river often rise from sources very near to some of the others, the head-springs being on opposite sides of the same dividing ridge of level table land, and in lands precisely alike. Some of these lands are of close and stiff soil, and some more sandy and quite light; but all are level, poor, and acid lands, and are mostly still under forest growth.

All persons, whether of the most or the least observant class, would concur in the opinion that this color proceeds from vegetable matter. This is obvious even in the waters of heavy rains, which when more than the level ridge lands can absorb, flow off, and are sometimes for a day or more thus passing in temporary streams to the nearest valley, or other descent. These surplus waters, while yet on the highest woodland, are colored to a greater or less depth of tint; and just as much in those which take their course towards James river, as the others which flow in the opposite direction to the Blackwater. The difference is that the former soon lose all such coloring matter, and in no case carry it to or even near James river, whilst the other waters increase in depth of color with the length of their course, or the duration of time they remain in the mill-ponds they pass through, or in the sluggish Blackwater river.

The supply of coloring matter is principally furnished by the dead and fallen leaves in the poor forest land, and is doubtless increased afterwards, both by the partial evaporation of the water, and by its dissolving still more of the soluble vegetable extract in the flat swampy grounds through which the streams flow into the Blackwater. This might indeed satisfactorily

account for these waters being *more deeply* colored than those which pass by a more rapid descent to James river. But these different circumstances do not serve at all to explain why the latter waters should soon lose, if they had it at first, the slightest trace of color.

The like circumstances are probably to be found to more or less extent in most of the counties on our tide-water rivers, as most of them have poor forest lands and some swampy streams in the interior.

As the opposite circumstances of the presence or absence of color in different waters is certainly not caused by such difference in the sources of supply, they must be caused by some subsequent action which serves to clear the waters in one locality, by combining with and taking off the dissolved coloring matter, and which action does not take place elsewhere, because there is no such efficient agent present. That agent I take to be carbonate of lime, or some other salt of lime in the soil in the one case, and which is present in quantity altogether insufficient for such action in the other case. According to the views which were presented (page 58) in regard to the power of calcareous earth to combine chemically with vegetable matter, if the colored waters should flow over soils furnished with calcareous matter, or into streams impregnated with any salts of lime, it would follow that the suspended or dissolved vegetable extract would combine with the calcareous matter of the soil in the water, and the new combination be precipitated, and be given to the soil, as manure, either immediately or remotely. This effect would be greatly aided if the streams swollen by rains actually passed in contact with and washed away exposed banks of marl. All recent rain water contains a small amount of carbonic acid, and that impregnation enables water to dissolve a proportional quantity of carbonate of lime, which is insoluble in water without this addition of carbonic acid. Therefore, in such circumstances the swollen streams and land floods would necessarily dissolve some carbonate of lime, which would be thus placed immediately and fully in mixture and perfect contact with the before dissolved vegetable coloring matter, and next must take place the combination of the two, and precipitation of the compound manure. The consequence must be, that the lands thus overflowed must be more or less enriched by every heavy rain; while the lands overflowed by the colored waters receive, or retain, nothing of soluble vegetable matter from this source, and may even lose part of what they had before received from the decay of their own growth, or other sources, by its being dissolved and carried off by such overflowing waters.

Now let us see how the actual results agree with these different causes, so far as the causes are known to exist. In the limited region particularly referred to above, the low grounds, subject to inundation by rains in a state of nature, and having beds of marl which the stream cuts through, are of much richer soil than any others, though the quantity of marl displaced by the stream (if indeed any such displacing be perceptible) would seem altogether too small in amount to produce such extent of fertilization by direct action. And it is believed, whether marl beds be so exposed or not, that the low-grounds on the streams of colorless water are always much better soils, and of more durable fertility, than those washed by colored waters. The latter soils being often swampy, are full of vegetable matter, and of course would be very productive when first drained and cultivated. But these soils are far from being among the most durable, and they are even at first, and when in best condition, very inferior lands to most low-grounds of prime quality; and the latter are always penetrated by streams, or had been sometimes covered by floods, which, however turbid at certain

times with suspended clay and mud, are never colored by vegetable extractive or soluble matter alone.

If we go farther for examples, the effects will be found to be still more striking. None of the lime-stone streams are ever colored; and their remarkable transparency, very far surpassing that of the most pure and limpid waters of the low country, show that the dissolved lime, which the mountain streams contain, serves to remove every thing of coloring matter. These lime-stone waters, and land floods from rains which also necessarily carry dissolved carbonate of lime, form the principal supply of the upper James river. But long before the waters reach the head of tide, not a particle of lime remains. The dissolved lime had been continually uniting with the suspended or dissolved vegetable matter, until no lime was left, and the precipitated compound had served to add more manure to the extensive low-grounds along the whole course of the upper James river, and which are so well known and deservedly celebrated for their great and enduring fertility and high value.

When a resident of the lower country first visits our mountain and lime-stone region, he cannot avoid observing and being forcibly impressed by the remarkable clearness of the waters. Pools and basins in the streams containing six feet depth of water, will appear to his unpractised eye as not deeper than two or three feet. And it is only by comparison, and by becoming acquainted with this really and perfectly clear lime-stone water, he learns that he had, in truth, never before seen a stream or pond of perfectly clear water. Though the dissolved matters may be in too small quantity to produce any appearance of color, they serve to impair the transparency of the water. And when any such coloring or vegetable matters are received into and intermixed with lime-stone streams, the vegetable matter is immediately combined with lime, and the compound precipitated; still leaving in the water a great excess of dissolved lime, scarcely diminished by the loss of the small part acting to clear the water of all coloring and vegetable impregnation.

From the large proportion of lime held in solution by lime-stone springs, and the streams proceeding from them, and also by rain floods passing over lime-stone soils, it must be inferred, (according to my views,) that such waters must very quickly combine with and precipitate all coloring matters, and, when not turbid with earthy matter, be as transparent as water can possibly be. Hence, the well known and remarkable transparency of such water is not directly caused (as commonly understood) by lime being contained in them—but because of the other adulterations being totally removed in combination with a part of that dissolved lime. Thus, the water is not in the least made crystalline and transparent because of what it *contains*, but because of what it has been *deprived of*. And, therefore, even after all the lime may have been precipitated, the water must retain its previous perfect transparency, unless subsequently impregnated with other coloring matter.

The additional supply of carbonic acid to water, which alone gives to it the power to dissolve or to retain in solution even the smallest proportion of carbonate of lime, is not strongly held. It is given off by the lime-stone water in its partial evaporation, and to every contact of atmospheric air; and this operation is increased by such agitation of the water as exposes a larger surface to the air. Hence, at all rapids of lime-stone streams, there is a peculiarly rapid and large deposition of carbonate of lime, let loose by the water because of the loss of the proportion of carbonic acid which before served to hold the lime dissolved in the water. This precipitation and gradual accumulation of carbonate of lime, at the rapids and

cascades of streams, is the formation called calcareous tufa or travertine, and vulgarly called "marl" in our mountain region, and which is presented in great quantity, and sometimes in enormous masses.

As lime-stone water so easily parts with the carbonic acid which enables it to hold lime in solution, it can scarcely be supposed that any of the acid remains after the water collects and remains long in the great reservoirs formed in lakes. But whether the water remains impregnated with carbonic acid, and of course with lime, or has lost both, the effect is the same, and is exhibited most strongly in the remarkable transparency of lakes so formed. Of such, I have never myself witnessed any but of Lake George, in New York. And after the long lapse of time since my short visit to this lake, I cannot remember to what extent the transparency of its waters was asserted, or what my own personal observation ascertained. I only remember certainly that the depth of water through which very small objects were distinctly visible was very great, and that no ground was left to doubt what is generally asserted and received as true on that head.

To return to the lands and waters of Prince George county. The water left by heavy rains, standing in shallow pools on the high level woodland, and flowing off in temporary rivulets, is seen to be colored by vegetable matter even within a mile of James river, just as it is found on the other lands sloping towards the Blackwater. But in either and every known case of such discoloration being caused, it is on poor and acid land. No such effect takes place on calcareous or even neutral soil, no matter how abundantly it is provided with dead leaves or other vegetable matter. Therefore it is manifest that it is not difference of locality, but difference of soil, which causes the different effects of the surplus rain water becoming tinged, and remaining tinged with vegetable extract, or otherwise remaining colorless. And also, after the water has been so tinged, that it depends on the difference of chemical composition in the soils over which it passes, or of the streams into which it is discharged, whether the color remains or is quickly discharged. And, as already stated, this difference of action and effect depends on the absence or presence of lime in the soils or waters to which the colored excess of rain water flows.

It is only in the surplus quantity of rain water, or that which is more than the soil can absorb, that this coloring matter is *seen*. But it is not the less certain that all of the much greater quantity of water from more gentle and more frequent rains which soak into the earth, must also be more or less tinged with the coloring matter of the leaves and other dead vegetable matter through which the water passes, and must take up in passing all that is then easily soluble, and not chemically combined with some other body. Thus, every gentle and soaking rain probably carries into the soil the greater part of all the then soluble vegetable matter, and that only which is soluble is all that is then completely ready to act as food for plants. The same rain, and the subsequent chemical action of air and warmth, cause the decomposition of the before insoluble vegetable matter to recommence, and in a few days there is a renewed supply of soluble or extractive matter formed in the vegetable cover of the soil, ready to be dissolved and to be carried into the earth by the next succeeding rain.

Such is Nature's process of furnishing alimentary manure, or the food of plants, to soils. And the source of supply is unlimited; for it is principally from the atmosphere and water, and by fixing their elements, (oxygen, nitrogen, hydrogen and carbon,) that the vegetable growths of soils, and consequently all alimentary manures, are formed.

As enormous then as is the continual waste of vegetable extractive matter and manure that is caused by every heavy rain, and which is always

evident to the eye in the black waters of so many ponds and streams, all this lost fertilizing matter must be in very small proportion, compared to the greater quantity that is carried more gradually and frequently into the earth. Much the greater part of the wood-land of lower Virginia is most freely and abundantly thus supplied, not only because of the abundant sources presented in a thick layer of fallen leaves, the growth of many successive years, but also because of the very level surface of the land, which obstructs the flowing off of the surplus rain water, and the general sandy and open texture of the soil and sub-soil, which operate to absorb quickly the water and its dissolved vegetable matter. Yet it is more especially these lands that show the least remaining and abiding store of this supply of vegetable manure. The soil, or all of the upper part which shows any color from containing vegetable matter, is usually not more than two inches thick on sandy soils, and still less on the stiffest; and all the portion below, (though necessarily manured by being often soaked to a foot or more with rain-water conveying all its dissolved vegetable extract,) is entirely barren and worthless. Such results would be as inexplicable as they are wonderful, but for the reasons afforded by the doctrine of the combining and fixing powers of carbonate of lime and vegetable salts of lime; the absence of which ingredients is the sole defect in these cases, and which, when present in soils, show results of fertilization altogether the reverse of these. Where lime is present in sufficient quantity, no coloring or manuring matter is lost to the soil in the flowing off of surplus water, nor in the wasteful and profitless decomposition of the greater quantity of coloring and alimentary matter soaked into the earth.

My observation was not attracted to the cause of the existence of black waters, and this application of the facts, until nearly the close of my residence in the country, and of my opportunities for personal and accurate observation. And I am well aware, and ready to admit, that previous observations, made by mere chance and without object, are worth very little comparatively. I therefore would be glad to have the attention of other observers drawn to this point, and any facts to be elicited that will either confirm or disprove my positions. From inquiries made of persons who have had ample opportunity to observe what waters were either permanently black or without tinge of such vegetable stain, I have heard the following general statements of facts, on which my comments will be offered as the facts are presented.

Streams and ponds of black waters are rarely seen above the falls of the rivers; and are believed to be very rarely found even twenty to thirty miles above. They are never seen in the still higher lime-stone region. If this opinion be correct, then these waters are confined exclusively (as they certainly are mainly) to the region of soil of the most *acid quality.* At the distance above the falls where black waters are never found, the high land was naturally in general of good quality, and the bottom or alluvial lands, on small streams, invariably of good soil. Of course these qualities indicate more of lime in the soil; and, according to my views, also the inability of water to become black, or at least to remain colored.*

The waters of Blackwater river and its tributary streams and swamps become darker in autumn, owing to the low level of the surface at that season. This is according to sound reason; as evaporation of the solvent fluid necessarily increases the strength of the solution. But this cause is held

* The extract translated from M. Puvis' '*Essai sur la Marne,*' and introduced at page 150 of this essay, affords testimony that the facts in regard to the existence and localities of black waters in France accord strictly with the views presented in this article. He says there that, "during the month of August, the water of the ponds on calcareous soil does not become blackish, as often happens in silicious ponds."

by most persons as secondary in force to another, viz: the dropping of the leaves, and especially of the numerous black-gum trees, and their berries, at that season, on the swamps and in the streams. Of course such is the source of the coloring matter; but it would produce no notable or abiding effect, but for the want of lime both in the soil and in the water. The extensive tide swamps on the creeks of James river, are covered with a dense growth of trees, of which a large proportion are black-gums. Yet in the numerous rills trickling or oozing out of these soils, after some days of low tides, I have never observed the water to be dark, or in the least discolored. Yet the soil of these tide swamps is as much of vegetable formation as any capable of bearing trees, and is believed to be more so than the swamp lands of Blackwater river and its tributaries. Therefore it is not the abundance of dead vegetable matter in a soil, nor the quantity or kind of leaves furnished by the trees growing on it, which alone or together produce colored waters. The earthy portion of the soil of these tide marshes and swamps, small as is its amount, is not acid, but neutral, and the lime contained serves to prevent the water remaining discolored.

Yet this is not always the case on tide swamps. The waters of Pocomoke river, flowing into the Chesapeake, are black, which I presume is owing to the deficiency of lime in the water and in the surface soil of the lands from which the waters flow.

The great Dismal Swamp of Virginia and its lake, and the still more extensive swamps and lakes of North Carolina, all present black waters, and which may all be accounted for by the reasons here given.

Neither is it necessary that marl beds should be wanting to produce the effect of black waters. It is only necessary that the marl (no matter how abundant) should be so far below the surface as not to affect the overflowing waters, and that the soil of the higher lands should be generally of acid quality. Such are the lands on Blackwater river and its tributaries. And though marl was scarcely known any where there twenty years ago, it is now known to be abundant, and generally to be found, though almost always a few feet below the surface of the low lands.

Many persons who would concur with me as to the premises and results, would yet ascribe the coloring of certain waters to the more level surface of the land, and the more sluggish and stagnant state of the waters; and would suppose the absence of coloring matter in the waters of the upper country to be caused by the rapidity of the descent and of the passage of the streams. This would be a correct view, if the matter in question were the degree of *intensity* of color, instead of the *existence or entire absence* of color. It is true, and obvious, that if the colored waters which now creep and stagnate over the level lands below the falls, had as rapid a descent and free discharge as the mountain torrents, their color could not be made deeper by the long infusion of the leaves, nor by evaporation of still waters. But though the color would be much more pale, its existence would not be the less certain. The source of coloring matter, the soaking of dead leaves, &c., in rain water, is as abundant in the upper as in the lower country; and the more rapid discharge of the waters, if no other cause of clearing them operated, would not prevent their becoming and remaining colored, as generally, and, however more pale in tint, would be seen as obviously, as in the most level lands. But this is not all. Though there is almost no level land, and therefore no swamps in the hilly or still less in the mountain region, there are mill-ponds in the lower hilly country, and natural lakes in the mountain region. If there was the slightest tint of dissolved coloring matter in the streams, the waters when collected in these deep reservoirs could not fail to exhibit the color much more deeply. Yet no one such fact is known, or is believed to have existence.

NOTE III.—*Extension of the subject of page* 68.

THE STATEMENTS OF BRITISH AUTHORS ON MARL, AND THEIR APPLICATIONS OF THE NAME, GENERALLY INCORRECT AND CONTRADICTORY.

Custom compels me to apply improperly the name *marl* to our deposites of fossil shells. But as I have defined the manuring by this substance, which is called *marling*, to be simply *making a soil calcareous*, or more so than it was before, any term used for that operation would serve, if its meaning was always kept in view. But this term, unfortunately, is of old and frequent use in English books, with very different meanings. The existence of these differences and errors has been generally stated in the foregoing pages of this essay, and I shall here present the proofs. The following quotations will show that the term *marl* is frequently applied in Britain to clays containing no known or certain proportion of calcareous earth—that when calcareous earth is known to be contained, it is seldom relied on as the most valuable part of the manure—and that in many cases *the reader is left in doubt whether the manure has served to increase, or diminish, or has not altered materially the amount of the previous calcareous contents of the soil.*

The passages quoted will exhibit so fully the striking contradictions and ignorance generally prevailing as to the nature and operation of marl, that it will scarcely be necessary for me to express dissent in every case, or to point out the errors or uncertainty of facts, or of reasoning, which will appear so manifestly and abundantly.

1. Kirwan, on the authority of Arthur Young and the *Bath Memoirs*, [1783,] states that,

"In some parts of England, where husbandry is successfully practised, *any loose clay is called marl:* in others, *marl is called chalk*, and in others, *clay is called loam.*"—*Kirwan on Manures*, p. 4.

2. The learned and practical Miller thus defines and describes marl, in the *Abridgment of the Gardener's Dictionary*, fifth London edition, at the article *marl*:

"Marl is a kind of clay which is become fatter and of a more enriching quality, by a better fermentation, and by its having lain so deep in the earth as not to have spent or weakened its fertilizing quality by any product. Marls are of different qualities in different counties of England."

He then names and describes ten varieties, most of them being very minutely and particularly characterized—and in only two of the ten is there any allusion to a calcareous ingredient, and in these, it is evidently not deemed to constitute their value as manures. These are "the cowshut marl" of Cheshire, which—

"Is of a brownish color, with blue veins in it, and little lumps of chalk or limestone,"—and "clay-marl; this resembles clay, and is pretty near akin to it, but is fatter, and sometimes mixed with chalk stones.

"The properties of any sorts of marls, by which the goodness of them may be best known, are better judged of by their purity and uncompoundedness, than their color: as if it will break in pieces like dice, or into thin flakes, or is smooth like lead ore, and is without a mixture of gravel or sand; if it will slake like slate-stones and shatter after wet, or will tumble into dust, when it has been exposed to the sun; or will not hang and stick together when it is thoroughly dry, like tough clay; but is fat and tender, and will open the land it is laid on, and not bind; it may be taken for granted that it will be beneficial to it."

3. *Johnson's Dictionary* (octavo edition) defines marl in precisely the words of the first sentence of Miller, as quoted above.

4. *Walker's Dictionary* (octavo edition) gives only the following definition—"Marl—a kind of clay much used for manure."

5. *A Practical Treatise on Husbandry*, (2nd London edition 4to, 1762,) which professes to be principally compiled from the writings of Duhamel, Evelyn, Home, and Miller, supplies the following quotations:

"But of all the manures for sandy soils, none is so good as marl. There are many different kinds and colors of it, severally distinguished by many writers; but their virtue is the same; they may be all used upon the same ground, without the smallest difference in their effect. The color is either red, brown, yellow, gray, or mixed. It is to be known by its pure and uncompounded nature. There are many marks to distinguish it by; such as its breaking into little square bits; its falling easily into pieces, by the force of a blow, or upon being exposed to the sun and the frost; its feeling fat and oily, and shining when 'tis dry. *But the most unerring way to judge of marl, and know it from any other substance*, is to break a piece as big as a nutmeg, and when it is quite dry, drop it into a glass of clear water, where, if it be right, it will dissolve and crumble, as it were, to dust, in a little time, shooting up sparkles to the surface of the water."—p. 27.

—Not the slightest hint is here of any calcareous ingredient being necessary, or even serving in any manner to distinguish marl. But afterwards, in another part of this work, when *shell marl* is slightly noticed, it is said:

"This effervesces strongly with all acids, which is perhaps chiefly owing to the shells. *There are very good marls which show nothing of this effervescence*: and therefore the author of the *New System of Agriculture* judged right in making its solution in water the distinguishing mark."—p. 29.

The last sentence declares, as clearly as any words could do, that, in the opinion of the author, no calcareous ingredient is necessary, either to constitute the character, or the value of marl. And though it may be gathered from other parts of this work, that what is called marl generally contains calcareous earth, yet no importance seems attached to that quality, any more than to the particular color of the earth, or any other accidental or immaterial appearance of some of the varieties described.

The "shell marl" alluded to above, without explanation might be supposed to be similar to our beds of fossil shells, which are called marl. The two manures are very different in form, appearance, and value, though agreeing in both being calcareous. The manure called shell marl by the work last quoted from, is described there with sufficient precision, and more fully in several parts of the Edinburgh Farmer's Magazine,* and in the Memoirs of the Philadelphia Agricultural Society.† It is still more unlike *marl*, properly so called, than any of the substances described under that name, in the foregoing quotations. This manure is almost a pure calcareous earth, being formed of the remains of small fresh-water shells deposited on what were once the bottoms of lakes, but which have since become covered with *bog* or *peat* soil. If I may judge from our beds of muscle shells, (to which this manure seems to bear most resemblance,) much putrescent animal matter is combined with, and serves to give additional value to these bodies of shells. This kind of manure is sold in Scotland by the bushel, at such prices as show that it is very highly prized. It seems to be found but in few situations, and though called a kind of marl, is never meant when that term alone is used generally.

A much older work than either of these referred to furnishes in part the definitions and even the words used above. This is the '*Systema Agriculturæ, the Mystery of Husbandry discovered*, published in 1687; and the author or compiler of that old work was probably indebted to others still older for his description of marl. For new books on agriculture, more

* See Farmer's Register, vol. i., p. 90.
† Vol. iii. p. 206.

especially, have been most generally made by compiling and copying from older ones.

"Marle is a very excellent thing, commended of all that either write or practise any thing in husbandry. There are several kinds of it, some *stony*, some *soft*, *white*, *gray*, *russet*, *yellow*, *blew*, black, and some *red*: It is of a cold nature and saddens land exceedingly; and very heavy it is, and will go downward, though not so much as lime doth. The goodness or badness thereof is not known so much by the colour, as by the purity and uncompoundness of it; for if it will break into bits like a dye, or smooth like lead-oar, without any composition of sand or gravel; or if it will slake like slate-stones, and slake or shatter after a shower of rain, or being exposed to the sun or air, and shortly after turn to dust, when it's thoroughly dry again, and not congeal like tough clay, question not the fruitfulness of it, notwithstanding the difference of *colours*, which are no certain signs of the goodness of the *marle*. As for the *slipperiness*, viscousness, fattiness, or oyliness thereof, although it be commonly esteemed a sign of good *marle*, yet the best authors affirm the contrary—*viz:* that there is very good *marle* which is not so, but lieth in the *mine* pure, dry and short, yet nevertheless if you water it, you will find it slippery. But the best and truest rule to know the richness and profit of your *marle*, is to try a load or two on your lands, in several places and in different proportions.

"They usually lay the same on the small heaps, and disperse it over the whole field, as they do their *dung*; and this *marle* will keep the land whereon it is laid, in some places ten or fifteen and in some places thirty years in heart: it is most profitable in dry, light, and barren lands, such as is most kind and natural for *rye*, as is evident by Mr. *Blithe*'s experiment in his chapter of *marle*. It also affordeth not its vertue or strength the first year, so much as in the subsequent years. It yields a very great increase and advantage on high, sandy, gravelly, or mixed lands. Though never so barren, strong clay ground is unsuitable to it; yet if it can be laid dry, *marle* may be profitable on that also."

The author then proceeds to direct the mode of application more particularly; and if there were any doubt as to his total ignorance (or otherwise denial) of calcareous earth being necessary to the constitution of marl, that doubt would be removed by a subsequent sentence.

"You shall observe, (saith Markham,) that if you cannot get dry, perfect, and rich marle, if then you can get of that earth which is called fuller's earth, (and where the one is not, commonly the other is,) then you may use it in the same manner as you should do marle, and it is found to be very near as profitable."

Evelyn's *Terra, or Philosophical Discourse of Earths, &c.*, delivered before the Royal Society in 1675, has the following passage:

"Of marle, (of a cold sad nature, a substance between clay and chalk,) seldom have we such quantities in layers as we have of forementioned earth; but we commonly meet with it in places affected to it, and 'tis taken out of pits, at different depths, and of divers colours, red, white, gray, blue, all of them unctuous, and of a slippery nature, and differing in goodness; for being pure and immixt, it sooner relents after a shower, and when dryed again, slackens, and crumbles into dust, without induration, and growing hard again. They are profitable for barren grounds, as abounding in nitre; and sometimes there has been found in marle, *delfs*, a vitriolic wood, which will kindle like coal."

The opinions expressed in the foregoing extracts, prove sufficiently that it was not the ignorant cultivators only, who either did not know of, or attached no importance to the calcareous ingredient in marl; and it was impossible that, from any number of such authors, an American reader could learn that either the object or the effect of *marling* was to render a soil more calcareous—or that our bodies of fossil shells resembled marl in character, or in operation as a manure. Of this, the following quotation will furnish striking proof—and the more so as the author refers frequently to the works of Anderson, and of Young, who treated of marl and of calcareous manures, in a more scientific manner than had been usual. This author, Bordley, cannot be justly charged with inattention to the instruction to be gained from books; for his greatest fault, as an agriculturist, is his

fondness for applying the practices of the most improved husbandry of England, to our lands and situations, however different and unsuitable—which he carried to an extent that is ridiculous as theory, and would be ruinous to the farmer who should so shape his general practice.

8. "I farmed in a country [the Eastern Shore of Maryland] where habits are against a due attention to manures: but having read of the application of marl as a manure, I inquired where there was any in the peninsula of the Chespeake *in vain*. My own farm had a grayish clay which to the eye was marl: but because it did not effervesce with acids, it was given up when it ought to have been tried on the land, especially as it rapidly crumbled and fell to mud, in water, with some appearance of effervescence."—*Bordley's Husbandry*, 2*nd ed.*, p. 55.

That peninsula, through which Mr. Bordley in vain inquired for marl, has immense quantities of the fossil shells which we so improperly call by that name. But as his search was directed to *marl* as described by English authors—and not to *calcareous earth* simply—it is not to be wondered at that he should neither find the former substance, nor attach enough importance to the latter, to induce the slightest remark on its probable use as manure.

9. The *Practical Treatise on Husbandry*, among the directions for improving clay land, has what follows:

"Sea sand and sea shells are used to great advantage as a manure, chiefly for cold strong [i. e. clay] land, and loam inclining to clay. They separate the parts; and the *salts* which are contained in them are a very great improvement to the land. Coral, and such kind of stony plants which grow on the rocks, are filled with salts, which are very beneficial to land. But as these bodies are hard, the improvement is not the first or second year after they are laid on the ground, because they require lime to pulverize them, before their salts can mix with the earth to impregnate it. The consequence of this is, that their manure is lasting. Sand, and the smaller kind of sea weeds, will enrich land for six or seven years; and shells, coral, and other hard bodies, will continue many years longer.

"In some countries *fossil shells* have been used with success as manure; but they are not near so full of salts, as those shells which are taken from the sea shore; and therefore the latter are always to be preferred. Sea sand is much used as manure in Cornwall. The best is that which is intimately mixed with coral."—p. 21.

After stating the manner in which this "excellent manure" is taken up from the bottom, in barges, its character is thus continued:

"It [i. e. the sea sand mixed with coral, as it may happen,] gives the heat of lime, and the fatness of oil, to the land it is laid upon. Being more solid than shells, it conveys a greater quantity of fermenting earth in equal space. Besides, it does not dissolve in the ground so soon as shells, but decaying more gradually, continues longer to impart its warmth to the juices of the earth."

Here are described manures which are known to be calcareous, which are strongly recommended--but solely for their supposed mechanical effect in separating the parts of close clays, and on account of the salts derived from sea water, which they contain. Indeed, no allusion is made to any supposed value, or even to the presence of calcareous earth, which forms so large a proportion of these manures: and the fossil shells, (in which that ingredient is more abundant, more finely reduced, and consequently more fit for both immediate and durable effects,) are considered as less efficacious than solid sea shells—and inferior to sea sand. All these substances, besides whatever service their salts may render, are precisely the same kind of calcareous manure, as our beds of fossil shells furnish in a different form. Yet neither here nor elsewhere, does the author intimate that these manures and marl have similar powers for improving soils.

The foregoing quotations show what opinions have been expressed by English writers of reputation—and what opinion would be formed by a

general reader of these and other agricultural works, of the nature of what is called marl, in England, as well as what is so named in this part of our country. I do not mean that other authors have not thought more correctly, and sometimes expressed themselves with precision on this subject. Mineralogists define *marl* to be a *calcareous clay**—and in this correct sense, the term is used by Davy, and other chemical agriculturists. Such authors as Young and Sinclair also could not have been ignorant of the true composition of marl—yet even they have used so little precision or clearness,, when speaking of the effects of marling, that their statements, (however correct they may be in the sense they intended them,) convey no exact information, and have not served to remove the erroneous impressions made by the great body of their predecessors. Knowing as Young did [see first quotation] the confusion in which this subject was involved, it was the more incumbent on him to be guarded in his use of terms so generally misapplied. Yet considering his practical and scientific knowledge as an agriculturist, his extensive personal observations, and the quantity of matter he has published on soils and calcareous manures, his omissions are more remarkable than those of any other writer. In such of his works as I have met with, though full of strong recommendations of marling, in no case does he state the composition of the soil, (as respects its calcareous ingredient,) or the proportion added by the operation—and generally notices neither, as if he viewed marling just as most others have done. These charges are supported by the following extracts and references.

10. Young's *Farmer's Calendar*, 10th London edition, page 40.—On marling. Through nearly four pages this practice is strongly recommended —but the manures spoken of, are regularly called "marl or clay," and their application, "marling or claying." Mr. Rodwell's account of his practice is inserted at length. On leased land he "clayed or marled" eight hundred and twenty acres with one hundred and forty thousand loads, and at a cost of four thousand nine hundred and fifty-eight pounds—and the business is stated to have been attended with great profit. At last, the author lets us know that it is not the same substance that he has been calling "marl or clay"—and that the marl effervesces strongly with acids, and the clay slightly. But we are told nothing more precise as to the amount of calcareous ingredients, either in the manures, or the soil—and even if we were informed on those heads, (without which we can know little or nothing of what the operation really is,) we are left ignorant of how much was clayed, and how much marled. It is to be inferred, however, that the clay was thought most serviceable, as Mr. Rodwell says—

"Clay is much to be preferred to marl on those sandy soils, some of which are loose, poor, and even a black sand."

11. Young's *Survey of Norfolk*, (a large and closely printed octavo volume,) has fourteen pages filled with a minute description of the soils of that county—but without any indication whatever of the proportion, presence, or absence, of calcareous earth in that extensive district of sandy soils, so celebrated for their improvement by marling—nor in any other part of the county. The wastes are very extensive: one of them (page 385) eighteen miles across, quite a desert of sand, "yet highly improveable." Of this also, no information is given as to its calcareous constitution.

12. The section on marl (page 402, of the same work) gives concise statements of its application, with general notices of its effects, on near

* Cleaveland's Mineralogy.

fifty different parishes, neighborhoods, or separate farms. Among all these, the only statements from which the calcareous nature of the manure may be gathered, are, (page 406,) of a marl that "ferments strongly with acids" —another, (page 409,) that marling at a particular place destroys sorrel— and (page 410) that the marl is generally calcareous, and that *that containing the most clay, and the least calcareous earth*, is preferred by most persons, but not by all.

13. Young's *General View of the Agriculture of Suffolk*, (an octavo of 432 pages of close print,) in the description of soils, affords no information as to any of them being calcareous, or otherwise; yet the author mentions (page 3) having analyzed some of the soils, and reports their aluminous and silicious ingredients. Nor can more be learned in this respect, in the long account afterwards given of the "marl" which has been very extensively applied also in the county of Suffolk. We may gather however, from the following extracts, that the "marl or clay" of Suffolk is generally calcareous, but that this quality is not considered the principal cause of its value; and further, that *crag*, a much richer calcareous manure, (which seems to be the same with our richest beds of fossil shells, or marl,) is held to be injurious to the sandy soils, which are so generally improved by what is *there* called marl.

"Claying—a term in Suffolk, which includes marling; and indeed the earth carried under this term is very generally a clay marl; though *a pure, or nearly a pure clay, is preferred for very loose sands.*"—*Young's Suffolk*, p. 186.

14. After speaking of the great value of this manure on light lands, he adds

"But when the clay is not of a good sort, that is, when there is really none, or scarcely any clay in it, but is an imperfect and even a hard chalk, there are great doubts how far it answers and in some cases has been spread to little profit."—p. 187.

15. "Part of the under stratum of the county is a singular body of cockle and other shells, found in great masses in various parts of the country, from Dunwich quite to the river Orwell, &c."—"I have seen pits of it to the depth of fifteen or twenty feet, from which great quantities had been taken for the purpose of improving the heaths. It is both red and white, and the shells so broken as to resemble sand. On lands long in tillage, *the use is discontinued*, as it is found to make the sands blow more." [That is, to be moved by the winds.]—p. 5.

15. The *Essay on Manures*, by Arthur Young, for which the author was honored with the Bedford medal, speaks distinctly enough of the value of marl being due to its calcareous ingredient, (as this author doubtless always knew, notwithstanding the looseness of most of his remarks on this head—) but at the same time he furnishes some of the strongest examples of absurd inferences, or of gross ignorance of the mode in which calcareous earth acts as an ingredient of soil, and the proportion which soils ought to contain. These are his statements, and his reasoning thereon:

"It is extremely difficult to discover, from the knowledge at present possessed by the public, what ought to be the quantity of calcareous earth in a soil. The best specimen analyzed by Giobert had 6 per cent.; by Bergman, 30 per cent.; by Dr. Fordyce, 2 per cent.; a rich soil, quoted by Mr. Davy, in his lecture at the Royal Institution, 11 per cent. This is an inquiry, concerning which I have made many experiments, and on soils of the most extraordinary fertility. In one, the proportion was equal to 9 per cent.; in another 20 per cent.; another, 3 per cent.; and in a specimen of famous land, which I procured from Flanders, 17 per cent. But the circumstance which much perplexes the inquiry is, that many poor soils possess the same or nearly the same proportions as these most fertile ones. To attain the truth, in so important a point, induced me to repeat many trials, and to compare every circumstance; and I am disposed to conclude, *that the necessity of there being a large proportion of calcareous earth in a soil depends on the deficiency of organic* [i. e. vegetable or animal] *matter;* of that organic matter which is [partly]

convertible into hydrogen gas. If the farmer finds, by experiment, that his soil has but a small quantity of organic matter, or knows by his practice that it is poor, and not worth more than 10s., 15s. or 20s. an acre, *he may then conclude that there ought to be* 20 *per cent. of calcareous earth in it ;* but if, on the contrary, it abound with organic matter, and be worth in practice a much larger rent, in that case his marl cart will not be called for, though there be but five per cent. or even less, of calcareous matter."—*Young's Essay on Manures*—Sect. 2.

It is scarcely necessary to show, that the opinion of calcareous matter being needed in larger quantities in proportion to the deficiency of putrescent matter, is directly opposed to the reasoning of this essay. If a poor soil were made to contain twenty per cent. of calcareous matter, by applying lime, chalk, or marl, the quantity and the expense would be so enormous as not to be justified by any possible return, and in truth, would lessen rather than increase the product of a poor soil. The fact named as strange by Young, that some rich soils contain very small, and others very large proportions of calcareous earth, is easily explained. If a natural soil contains any excess of calcareous earth, even though but one per cent., it shows that there is that much to spare after having served every purpose of neutralizing acids and combining with putrescent matter. If there were twenty per cent. more of calcareous matter, it would be useless, until met by an additional supply of putrescent matter. Young's statement that some poor soils agree precisely with other rich soils, in their contents of calcareous earth, does not necessarily contradict my doctrine that a proper proportion of calcareous earth will enable any soil to become rich, either in a state of nature, or under mild cultivation, and for the following reasons:

16. 1st. The correctness of Young's analyses may be well doubted; and if he used the then usual process for separating calcareous earth, he was obliged to be incorrect on account of its unavoidable imperfection, as has been already explained at page 36. 2d. It cannot be known positively what was the original state of fertility of most cultivated soils in England, nor whether they were subjected to exhausting or improving cultivation, for centuries before our information from history begins. 3d. Lime has been there used for a long time, and to great extent; and chalk and marl were applied as manures during the time of the Roman conquest, as stated by Pliny, (say 1700 years ago) so that it cannot be always known whether a soil has received its calcareous ingredient from nature, or the industry of man. 4th. It is known that severe cropping after liming, and also excessive doses of calcareous earth, have rendered land almost barren; of which the following extracts offer sufficient proof:—

" Before 1778, [in East Lothian,] the *out-field* did not receive any dung except what was left by the animals grazed upon it. In many cases, out-field land was limed ; and often with singular advantage. The after management was uniformly bad; it being customary to crop the limed out-field with barley and oats successively, so long as the crop was worth cutting. In this way numerous fields suffered so severely as to be rendered almost sterile for half a century afterwards." *Farmer's Magazine*, p. 53, vol. xii.

" An overdose of shell marl, laid perhaps an inch thick, produces for a time large crops. But at last it renders the soil a *caput mortuum*, capable of neither corn nor grass; of which, there are too many examples in Scotland, &c. *Gentleman Farmer*, p. 378.

17. Yet the last writer (Lord Kames) elsewhere states, (at page 379,) that as much clay marl as contains 1500 bolls, (or 9000 bushels,) of pure calcareous earth to the acre, is not an overdose in Scotland.

18. "*Marl.* Of this substance, there are four sorts, rock—slate—clay—and shell marl. The three former are of so heavy a nature that they are seldom conveyed to any distance ; though useful when found below a *lighter* soil. But shell marl is specifically

lighter, and consists entirely of calcareous matter, (the broken and partially decayed shells of fish,) which may be applied as a top-dressing to wheat and grass, when it would be less advantageous to use quick-lime." [This is the kind of manure referred to in extract 5, and there more particularly described.] "In Lancashire and Cheshire, clay, or red marl, is the great source of fertilization, &c."—"The quantity used is enormous; in many cases about three hundred middling cart loads per acre, and the fields are sometimes so thickly covered as to have the appearance of a red soiled fallow, fresh ploughed."—*Sinclair's Code of Agriculture, American ed.* (*Hartford*) p. 138.

This account of the Lancashire improvements made by red clay marl closes with the statement that "the effects are represented to be beneficial in the highest degree," which is fully as exact an account of profit, or increased production, as we can obtain of any other marling. Throughout, there is no hint as to the calcareous constituents of the soil or the manure, or whether either rock, clay or slate marls, generally, are valuable for that or for other reasons; nor indeed could we guess that they contained any calcareous earth, but for their being classed with many other substances, under the general head of calcareous manures.

19. "The means of ameliorating the texture of *chalky* soils, are either by the application of clayey and sandy loams, pure clay, or *marl*."—"The chalk stratum sometimes lies upon a thick vein of black tenacious marl, of a rich quality, which ought to be dug up and mixed with the chalk."—*Code of Agriculture*, p. 19.

20. Dickson's *Farmer's Companion.*—The author recommends "argillaceous marl" for the improvement of *chalky soils;* and for sandy soils, "where the calcareous principle is in sufficient abundance, *argillaceous marl*, and clayey loams," are recommended as manures.

21. "Chalky loam. The best manure for this soil is clay, or *argillaceous marl*, if clay cannot be had; because this soil is defective principally in the argillaceous ingredient."—*Kirwan on Manures*, p. 80.

The evident intention and effect of the marling recommended in all the three last extracts, is to *diminish* the proportion of calcareous earth in the soil.

22. In a *Traveller's Notes* of an agricultural tour in England, in 1811, which is published in the third volume of the *Edinburgh Farmers' Magazine*, the following passages relate to Mr. Coke's estate, Holkham, and to Norfolk generally.

"Holkham.—The soil here is naturally very poor, being a mixture of sand, *chalk*, and flint stones, with apparently little mixture of argillaceous earth—*the subsoil, chalk or lime-stone every where.*" Page 486. "As the soil of the territory [of Norfolk generally] through which I passed, seems to have *a sufficient mixture of calcareous earth naturally*, I learn they do not often lime their lands; but *clay marl* has been found to have the most beneficial consequences on most of the Norfolk soils." p. 487.

23. "In Norfolk, they seem to *value clay more than marl*, probably because their sandy soils already contain *calcareous parts.*"—*Kirwan on Manures*, p. 87.

From this and the preceding quotation it would follow, that the great and celebrated improvements in Norfolk, made by marling, had actually operated to *lessen the calcareous proportion of the soil*, instead of increasing it. Or, (as may be deduced from what will follow,) if so scientific and diligent an inquirer as Kirwan was deceived on this very important point, it furnishes additional proof of the impossibility of drawing correct conclusions on this subject from European books—when it is left doubtful, whether the most extensive, the most profitable, and the most celebrated improvements by "marling" in Europe, have in fact served to make the soil *more* or *less* calcareous.

Most of the extracts which I have presented, are from British agriculturists of high character and authority. If such writers as these, while

giving long and (in some respects) minute statements of marl, and marling, omit to tell, or leave their readers to doubt, whether the manure or the soil is the most calcareous—or what proportions of calcareous earth, or whether any is present in either—then have I fully established that the American reader who may attempt to draw instruction from such sources, as to the operation, effects and profits of either marl or calcareous manures in general, will be more apt to be deceived and misled than enlightened.

I have now to refer to an author, whose works, well known as they may be to others, had not come under my view until after the publication of most of the foregoing extracts. Otherwise, Marshall would have been stated as an exception to the general silence of British authors as to the true and precise nature of what they treated of as *marl*. But though he has not been like others, so faulty as to leave in doubt what was the character and value of the marls of which he spoke, and the nature of their operation on the soils to which they were applied, still no other writer furnishes stronger proof of the general ignorance and disregard of the nature of marls and calcareous manures, and of their mode of operation; and even the author himself is not free from the same charge as will be shown. I shall quote more at length from Marshall, because he presents the strongest opposition to what I have stated as to the general purport of publications on marling; and also, because whatever may be their character, there is much to interest the reader in his accounts of the opinions and practices of those who have used calcareous manures longest and most extensively, although without knowing what they were doing.

In his *Rural Economy of Norfolk*, the "marls" and "clays" most used in the celebrated improvements of that county are minutely described, and the chemical composition stated, showing that both are highly calcareous. Of the "marls" or chalks, most used for manure in Norfolk, he analyzed three specimens, and one of clay, and found the proportions of pure calcareous matter as follows:

Chalk marl of Thorp-market, contained, per cent. - - -	85
Soft chalk of Thorp-next-Norwich, - - - - - - -	98
Hard chalk of Swaffham, almost pure,—nearly - - - -	100
Clay marl of Hemsby, - - - - - - - - -	43

24. Of these he spoke previously and in general terms, thus:

"The central and northern parts of the district abound, universally, with a whitish-colored chalk marl; while the Fleg hundreds, and the eastern coast, are equally fortunate in a gray-colored clay marl.

"The first has, in all probability, been in use as a manure many centuries; there are oaks of considerable size now going to decay in pits which have obviously been heretofore in use, and which, perhaps, still remain in use, as marl-pits.

"The use of clay marl, as a manure, seems to be a much later discovery; even yet, there are farmers who are blind to its good effect; because it is not *marl*, but "clay;" by which name it is universally known.

"The name, however, would be a thing of no import, were it not indiscriminately applied to unctuous earths in general, whether they contain, or not, any portion of calcareous matter. Nothing is "marl" which is not white; for, notwithstanding the county has been so long and so largely indebted to its fertilizing quality, her husbandmen, even in this enlightened age, remain totally ignorant of its distinguishing properties; through which want of information much labor and expense is frequently thrown away.

"One man, seeing the good effect of the Fleg clay, for instance, concludes that all clays are fertile, and finding a bed of strong brick earth upon his farm, falls to work, at a great expense, to "claying"—while another, observing this man's miscarriage, concludes that all clays are unprofitable; and, in consequence, is at an expense, equally ill applied, of fetching "marl" from a great distance; while he has, perhaps, in his own farm, if judiciously sought after, an earth of a quality equally fertilizing with that he is throwing away his time and his money in fetching.—*Marshall's Norfolk*, vol. i., p. 16.

Yet it is remarkable, that Marshall should not have intimated whether the Norfolk soils were naturally calcareous, (as the two writers just before quoted declare,) or not; and therefore we are still left to guess whether these manures served to increase the calcareous quality of soils already possessing that quality in a high degree—or to give it to soils devoid of it before.

Other passages will now be quoted from the same, and from other similar works of Marshall's, to show the prevailing ignorance of the ingredients, and operation of the marls sometimes prized, and sometimes contemned, with as little reason in the one case as the other, by farmers in various parts of England.

25. "The principal part of his estate, however, is of a much shallower soil, not deeper than the plough goes; and its present very amazing fertility he ascribes in a great measure to his having clayed it. Indeed to this species of improvement the fertility of the Fleg Hundred is allowed to be principally owing.

"Mr. F. gave me an opportunity of examining his clay pit, which is very commodious; the uncallow is trifling, and the depth of the bed or jam he has not been able to ascertain. It is worked, at present, about ten or twelve feet deep.

"The color of the fossil, when moist, is dark brown, interspersed with specks of white, and dries to a color lighter than that of fuller's earth; on being exposed to the air, it breaks into small die-like pieces.

"From Mr. F's. account of the manner of its acting, and more particularly from its appearance, I judged it to be a brown marl, rather than a clay; and, on trying it in acid, it proves to be strongly calcareous; effervescing, and hissing, more violently than most of the white marls of this neighborhood: and what is still more interesting, the Hemsby clay is equally turbulent in acid as the Norwich marl, which is brought by water forty miles into this country, at the excessive expense of four shillings a load upon the staith; besides the land carriage. [The strength of this Hemsby clay is stated above.]

"It is somewhat extraordinary that Mr. F., sensible and intelligent as he is, should be entirely unacquainted with this quality of his clay; a circumstance, however, the less to be wondered at, as the Norfolk farmers, in general, are equally uninformed of the nature and properties of marl."—*Marshall's Norfolk*, vol. ii., page 192.

The following is a remarkable instance, in a particular district, of a clay very poor in calcareous matter, being considered and used as valuable manure, and a very rich marl equally accessible, being deemed inferior.

26. "The marl is either an adulterate chalk, found near the foot of the chalky steeps of the West Downs, lying between the chalk rock and the Maam soil, partaking of them both—in truth, a marl of the first quality, or a sort of blue mud, or clay, dug out of the area of this district, particularly, I believe, on the south side of the river. This is said to have been set on with good effect; while the former is spoken of, as of less value; whereas, the white is more than three-fourths of it calcareous; while the blue does not contain ten grains, per cent., of calcareous matter."—*Marshall's Southern Counties*, p. 175.

The greater part of what are called marls in the following extract, and used as manure, contain so little calcareous earth, that whatever power they may exert, must be owing to some other ingredient. Yet, without Marshall's analysis, they would be considered to deserve the character of calcareous manures, as much as any others before named.

27. "The red earth which has been set upon the lands of this district, in great abundance, as 'marl,'—is much of it in a manner destitute of calcareous matter; and, of course, cannot, with propriety, be classed among marls.

"Nevertheless, a red fossil is found, in some parts of the district, which contains a proportion of calcareous matter.

"The marl of Croxall (in part of a stone-like, or slaty contexture, and of a light red color) is the richest in calcareosity; one hundred grains of it afford *thirty grains* of calcareous matter; and seventy grains of fine, impalpable, red-bark-like powder.*

* This marl is singularly tenacious of its calcareous matter; dissolving remarkably slowly. One hundred grains, roughly pounded, was twenty-four hours in dissolving;

"And a marl of Elford (in color and contexture various, but resembling those of the Croxall marl) affords near *twenty grains*.

"Yet the marl of Barton, on the opposite side of the Trent—though somewhat of a similar contexture, but of a darker more dusky color—is in a manner destitute of calcareosity! one hundred grains of it yielding little more than one grain—*not two grains* of calcareons matter. Neverthless, the pit, from which I took the specimens analyzed, is an immense excavation, out of which many thousand loads have been taken.

"And the marls of this neighborhood (which mostly differ in appearance from those described, having generally that of a blood-red clay, interlayered, and sometimes intermingled with a white gritty substance) are equally poor in calcareosity.

One hundred grains of the marl of Statford (which I believe may be taken as a fair specimen of the red clays of this quarter of the district) afford little more than *two grains* of calcareous matter.* Yet this is said to be 'famous marl;' and from the pits which now appear, has been laid on in great abundance.

"I do not mean to intimate, that these clays are altogether destitute of fertilizing properties, on their first application. It is not likely that the large pits which abound in almost every part of the district, and which must have been formed at a very great expense, should have been dug, without their contents being productive of some evidently, or at least apparently good effect, on the lands on which they have been spread.

I confess, however, that this is but conjecture; and it may be, that the good effect of the marls, first described being experienced, the *fashion* was set; and the distinguishing quality being unknown, or not attended to, marls and clays were indiscriminately used."—*Marshall's Midland Counties*, vol. i. p. 152.

28. "On the southern banks of the Anker, is found a gray marl; resembling in general appearance the marl of Norfolk, or rather the fuller's earth of Surrey. In contexture it is loose and friable.

"This earth is singularly prodigal of its calcareosity. The acid being dropped on its surface, it flies into bubbles as the Norfolk marl. This circumstance, added to that of a striking improvement, which I was shown as being effected by this earth, led me to imagine that it was of a quality similar to the marls of Norfolk.

"But, from the results of two experiments—one of them made with granules formed by the weather, and collected on the site of improvement, the other with a specimen taken from the pit, it appears that one hundred grains of this earth contain no more than *six grains* of calcareous matter! the residuum a cream colored saponaceous clay, with a small proportion of coarse sand."—*Marshall's Midland Counties*, vol. i. p. 155.

The last extracts suggested a remark which ought to have been made earlier. When there is so much general ignorance prevailing among practical farmers as to what they call marl, it cannot be expected that the most intelligent writers can be correct, when attempting to record their practices. When Arthur Young, for example, reports the effects of marl in fifty different localities, as known from the practice of perhaps more than several hundred individuals, it must be inferred that he uses the term, generally, as they did from whom his information was gathered, and in very few cases, if at all, as learned by his own analyses. Therefore, it may well be doubted whether the uncertainty as to the character of marl does not extend very generally to even the most scientific writers on agriculture.

As the foregoing extract exhibits the use of "marls" destitute of calcareous earth, so the following shows, under the name of *sea sand*, a manure which is in its chemical qualities a rich *marl* (in our sense) or calcareous manure.

29. "*Sea sand.* This has been a manure of the district, beyond memory or tradition. "There are two species still in use: the one bearing the ordinary appearances of sea sand, as found at the mouths of rivers; namely a compound of the common sand and mud; the other appears to the eye clean fragments of broken shells without mixture; resembling in color and particles, clean-dressed bran of wheat.

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and another hundred, though pulverized to mere dust, continued to effervesce twelve hours; notwithstanding it was first saturated with water, and afterward shook repeatedly. The Breedon stone, roughly pounded, dissolved in half the time; notwithstanding its extreme hardness.

* Lodged not in the substance of the clay, but in its natural cracks or fissures.

"By analysis, one hundred grains of the former contain about thirty grains of common silicious sea sand, with a few grains of fine silt or mud; the rest is calcareous earth mixed with the animal matter of marine shells.

"One hundred grains of the latter contain eighty-five grains of the matter of shells, and fifteen grains of an earthy substance, which resembles in color and particles, minute fragments of burnt clay or common red brick.

"These sands are raised in different parts of Plymouth Sound, or in the harbor; and are carried up the estuaries in barges; and from these on horseback, perhaps five or six miles into the country; of course at a very great expense, yet without discrimination, by men in general, as to their specific qualities. The shelly kind, no doubt brought them into repute, and induced landlords to bind their tenants to the use of them; but without specifying the sort—and the bargemen, of course, bring such as they can raise and convey at the least labor and expense. It is probable that the specimen first mentioned, is above par, as to quality: I have seen sand of a much cleaner appearance, travelling towards the fields of this quarter of the country; and near Beddiford, in North Devonshire, I collected a specimen under the operation of "melling" with mould, which contains eighty grains per cent. of clean silicious sand!"—*Marshall's West of England*, vol. i., page 154.

It might be inferred from all these proofs of Marshall's knowledge of calcareous earth constituting the real value of marls, that he could scarcely miss the evident corollary to that proposition; that the valuable operation of calcareous manures is to render soils more calcareous, and that the knowledge of the nature of the manure and the soil would sufficiently indicate when the application of the one to the other was judicious or not. But the following expression of opinion (*Marshall's Yorkshire*, vol. i., p. 377) is not only strongly opposed to those deductions, but to the general purport of all his truths which I have before quoted.

30. "Nothing at present but comparative experiments can determine the value of a given lime, to a given soil; and no man can with common prudence lime any land upon a large scale, until a moral certainty of improvement has been established by experience."

If this be true, then indeed is there no true or known theory, or established precepts, for applying either lime or any calcareous manure. It amounts to saying, that every new application is a mere experiment, the result of which cannot even be conjectured from any facts previously known of other soils and other manures.

31. The next quotation, which is from an editorial article in the *Farmers' Journal* of July 38, 1823, shows that the old opinion still prevails, that marl is profitable only on sandy lands; which opinion carries with it the inference that it is the argillaceous quality, rather than the calcareous that operates. The editor is remarking on a new agricultural compilation by a Mr. Elkinson, and ridiculing the author for his solemn annunciation of the truism, (in the editor's opinion,) that "marling on sand is more useful than on clay land." The reputation of Mr. Elkinson, says the editor

"May remain undisturbed among the farmers of Lincolnshire for a long time, who may never have chanced to meet with the old proverb, or have taken a journey into the sandy district of Norfolk. We really do not know whether it be as old as Jarvais Markham or not: but we have seen the following lines in black letter:

He that marls sand, may buy land;
He that marls moss, shall have loss;
He that marls clay, throws all away!'

The editor then passes to a subject on which his admitted ignorance serves to prove that the improvement gained by marling could not be simply the making a soil calcareous—for, upon that ground, when marl has once been plentifully given, and the land afterwards worked poor, there can be neither reason nor profit in a second marling. Yet, as if the mode of operation was altogether unknown, this passage follows:

"It was once asked of the editor by a very good practical Norfolk farmer, 'whether land which had been once marled and worn out would receive the same benefit from a second marling?' It was answered, that an experiment made on one field, or on one acre, would decide the point, but *conjecture led to nothing conclusive.* It has often been observed that loose land, after having been marled and out cropped, deposited its marl in the subsoil, which therefore became more retentive [of water;] and it has been suggested, that deep ploughing ought to be tried, to bring this marl again to the top. We hope that the point here in question has before now been settled by practice in both ways; though at the above period, (about 1806,) such facts had not reached the gentleman alluded to, although a very intelligent man."

The singular fact stated above, of marl, and also of lime, sinking and forming a layer below the soil, is stated by other British writers. No such result has been found in this country, so far as I am informed. Nor do I believe that it can occur, except when the calcareous matter is too abundant to form a chemical combination with the soil, or with the matters in the soil. According to my views of the manner in which calcareous earth acts, it must form such combination in the soil, to be useful—and if so combined, it cannot be separated, and sink through the soil by the force of gravity, or any other cause.

32. The next article is probably one of the latest publications on marl, yet contains as little of truth, and for its length, as much that is false and absurd, as if it had been written a century ago. It appeared (in English) in the *Quarterly Journal of Agriculture*, (for Dec. 1834,) and is there quoted from the *Magazine of Gardening and Botany*, and as written by Count Gyllenborg. As no contradictory remarks are appended by either of the editors of these highly respectable journals, it may be considered as in some measure giving their countenance to the opinions here presented.

Though the writer speaks of "acid in the land," yet the succeeding part of the sentence, which speaks of "imbibing it from stagnating water," shows that no correct or definite idea was attached to the term "acid." The entire piece is copied.

"*How far marl contributes to the fertility of soils,* 1st. Not materially, for it is devoid of every unctuous and saline matter. 2d. But instrumentally it promotes vegetation, by attracting the moisture, acids or oils in the atmosphere, which enrich the land. As this quality becomes stronger by burning, how wisely would the farmers act in using it after being calcined. It promotes vegetation, by destroying the acid actually in the land, or removing that which it might be in danger of imbibing from stagnating water, and hence, also, it may perhaps help to prevent a too acid disposition in the seeds. By dissolving every unctuous substance in the land, whence arises a saponaceous mixture soluble in water, and fitted to enter into the pores of vegetables. By destroying the toughness of strong soils, for, by its quickly crumbling in the air, the cohesion of a clayey soil is diminished, it is rendered easier to cultivate, and more fit to carry on the growth of plants. It gives greater solidity and firmness to loose or sandy soils; and, as before observed, it contributes to their fertility, by attracting into this dry soil the nutritive contents of the air. There are some who think that marl should not be laid on sandy soils; but experience has taught us to conclude otherwise, having observed that the most beneficial effects are produced from it on very light and sandy soils. Marl may hurt land by too long and a too plentiful use of it; for, from its calcareous quality, it much resembles lime. It soon dissolves and consumes the fat of the land—and it loosens a clayey soil, so that it becomes less retentive of moisture. Marl is, however, very different, according to its being more or less calcareous or clayey; and therefore judgment is more or less necessary to adapt it to the nature of the soil. Some have recommended it chiefly for wet and cold soils, and many farmers have observed that it is most useful when mixed with rich manures. Neither of these observations, however, seems to be correct; but a due care should be taken that this manure be adapted to the soil on which it is laid."

NOTE IV.

DESCRIPTION AND ACCOUNT OF THE DIFFERENT KINDS OF MARL, AND OF THE GYPSEOUS EARTH, OF THE TIDE-WATER REGION OF VIRGINIA.

Report to the State Board of Agriculture, by Edmund Ruffin, Member and Corresponding Secretary of the Board. 1842.

Within the last twenty-five years there have been produced from the application of calcareous manures more improvement and benefit, both agricultural and general, in lower Virginia, than from all other means and sources, numerous and valuable as have been the agricultural improvements made. And for the latter half of that time, no one agricultural subject has been treated of more at length in the publications of this state. Still, there is much required to be known; and it has very often, and not less so recently than formerly, been required of the writer, who has furnished to the press the larger part of all that has thence proceeded on this subject, to give answers to inquiries, which, however variously worded, amounted in substance to the question, "What is marl?"—or "Is my marl, (or whatever earth was so termed,) *good* marl, and likely to be profitable as manure?" It has therefore appeared to the writer that it would be useful to prepare something like a natural history or general and full description of the marls of lower Virginia; and also of the kindred and yet very different mineral manure, the gypseous earth, or "green-sand" earth, concerning which latter so much error and delusion have been spread and long maintained, and so little of truth or useful information derived from the sources generally respected as the highest authority.

The main difficulty in the treating of this subject is presented in the outset in the very term "*marl*," which is altogether misapplied now in this country, though not so much as it has been and perhaps still is in England. Since this general course of misapplication was set forth by the writer at length in the 'Essay on Calcareous Manures,' there have become general in this country still other misapplications of this always misapplied term. For the "green-sand" earth of New Jersey, which before had been called "marl" by illiterate farmers only, has been since received under that name by chemists and the scientific reporters of geological surveys; and thus confusion has become still "worse confounded." In the following pages, I shall be compelled, as heretofore, to yield in part to such misapplication of the term; but at the expense of some otherwise useless repetition, and frequent explanation, shall hope to avoid misleading readers as to each of the particular earths under consideration. And, in general, I shall in no case apply the term *marl* to any but a *calcareous earth*, and of which the calcareous ingredient or proportion of carbonate of lime is deemed sufficient to constitute the most important, if not indeed forming the only important or appreciable agent of fertilization; and therefore I shall not so designate either the fine clays, (not calcareous, or very slightly so,) called marl in England, or the green-sand earths of New Jersey, Delaware or Virginia, when containing very little or no carbonate of lime.

True marl, as correctly understood and described by mineralogists, is a fine calcareous clay, containing very little silicious sand, and none coarse, or separate; of firm texture—not plastic, or adhesive; does not bend under pressure, but breaks easily. It is manifest, from its laminated appearance and fracture that this true marl has been originally suspended in rapidly flowing waters, and deposited at the bottom by subsidence, when the waters became comparatively still; as when a rapid river, turbid with calcareous clay, reached a lake. Thus, from its manner of formation, such marl, however argillaceous, was of a texture very different from the almost pure,

or the most tenacious clays. The carbonate of lime also tends to preserve an open and mellow texture in true marls, disposing the lumps to readily yield and crumble, or fall to powder or to thin flakes, under atmospherical influences, which would only affect clay by making it an intractable sticky mortar when wet, or lumps of almost stony hardness when dry. Moreover, there seems good reason to believe that in true marl there is a *chemical combination* (and not merely a mixture) of the argillaceous and calcareous ingredients, induced by their suspension in water, when the particles of both were in the finest possible state of division, and most intimate intermixture, while so suspended. Besides the crumbling quality just stated, so different from clay, there is a still stronger reason for believing that the calcareous and the silicious parts of true marl are chemically combined, which is, that they cannot be separated by mechanical means, such as agitation and subsidence in water. For the suggestion that the different earthy parts of true marl are in a state of chemical combination with each other, I am indebted to the '*Essai sur la Marne*,' of M. Puvis, which work, in an abridged form, I translated and published in the third volume of the Farmers' Register. The author there also states that the marls of France are principally, if not always, of fresh-water formation, as is shown by the shells they contain being either such as belong to rivers and lakes or to the land. This is different from any thing known in lower Virginia; all our known marls, whether properly or improperly so termed, being deposites made in a former sea, and the shells being those of sea-animals.*

But though it is proper to describe that which only is truly "marl," before speaking of what is improperly so called, it is also true that there is nothing to tell of the use of any true marl in Virginia, and scarcely of its existence in the tide-water region. I have as yet seen it in but few places, and then overlying ordinary beds of fossil shells, and intermixed therewith. This marl was thus found in two of my diggings, one on Coggins' Point farm and the other at Shellbanks. In both cases, though perfectly characterized, the quantity of true marl was too small to be used separately from the more calcareous and much thicker stratum of shell marl below. This true marl was in many horizontal layers, seldom more than an inch in thickness, separated by other layers, sometimes very thin, of almost pure shells

* "It may be of some interest to scientific investigators to know more particularly the shells of these marls of France. In a catalogue annexed to the original '*Essai sur la Marne*,' the author names the following shells:

In a marl sent from St. Trivier—yellowish, compact, of homogeneous appearance, and coming to pieces finely and easily in water—

Land shell—Turbo elegans.

River shells—Helix fasicularis, Helix vivipara, †Helix tentacula, †Mya Pictorum.

In a marl from Cuiseaux, Saône et Loire—

River shell—Melanopside (of Lamarck.)

In a marl from Leugny, in Yonne—

Land shell—†Chassilie ridee (of Lamarck. and Draparnaud,) †Helix lubrica.

In a marl from St. Priest in Dauphiny—earthy, yellowish, very easy to crumble in water—

Land shell—†Ambrette alongée (of Lamarck and Draparnaud, *Helix hispida.

In an analogous formation of marl, in the basin of the Rhone, beween Meximieux and Montluel, the Helix striée, a land species is found in great abundance."

M. Puvis states that among these, and among all the species of shells found in the marls of the basins of the three great rivers, Saône, Rhone and Yonne, there are no remains of sea shells. All seem to have been formed under fresh water. "But (he continues) as these marls contain land shells, often in great abundance, we must conclude, that the revolution which heaped up the marls, has been preceded by a time in which the land was not covered by water, in which the earth producing vegetables, permitted the multiplication of the species of land shells which were found in these marls."—*Essai sur la Marne*, p. 8 to p. 24, and translation in *Farmer's Register*, iii., note to p. 692.

† Living species are still found in the same region similar to those marked thus.

broken very small, with some only of the very smallest entire. The pure argillaceous marl is blue (though sometimes of buff color,) firm and compact breaks easily, but does not bend however moist, and is cut smooth by a knife, leaving a surface like that of hard soap. This marl contained, in the argillaceous part, free from the shelly parts, only 10 per cent. of calcareous matter. Several other specimens, from other localities in the same region, were about the same strength. Therefore, even if more plenty, there would seem to be no inducement to use our true marl, where the beds of fossil shells, called marl, and usually so much richer in calcareous matter, can be drawn from. But in Europe, clay marl is reported as rich as 40 to 60 per cent. of calcareous matter, and indeed richer, gradually running into lime-stone. In our lime-stone mountain region, (and especially in the places of ancient lakes and ponds, now drained or filled up, there probably may be found bodies of true or clay marl, comparing in strength as manure, and in abundance, with the valuable European deposites.

But though it is proper to know, and to bear in mind, what is understood by the term marl by mineralogists, and by the well informed English and French agricultural writers, in regard to the extensive marlings in those countries, yet it is necessary in Virginia to conform generally to the usage which gives the name of marl to all earths mixed with fossil shells; and as the term is so far improperly extended, I would carry it still farther, and make it embrace all natural calcareous earths not of stony hardness. This arrangement then would indeed include true marl, but merely as one class, and that one of the least noticeable for abundance or value of all in this country. The following scheme of classification will conform to this view, and serve to make more clear the descriptions that will follow.

- MARL, or Shelly earth, or earth otherwise calcareous in part.
  - I. ARGILLO-CALCAREOUS MARL. deposited in and from still water.
  - II. SHELL MARL.
    - 1. FRESH WATER SHELLS, grown in & deposited at bottom of lakes.
      - MIOCENE MARL.
        - *a.* Yellow Miocene Marl.
          - *aa.* Yellow sandy marl.
          - *bb.* Yellow clay marl.
        - *b.* Blue Miocene Marl.
          - *cc.* Blue sandy marl.
          - *dd.* Blue clay marl.
    - 2. FOSSIL SHELLS, or Ancient Sea Shells
      - EOCENE MARL.
        - *c.* Calcareous Marl, with very little if any Green-sand.
        - *d.* Calcareous matter and green-sand, both considerable.
        - *e.* Gypseous or Green-sand earth, with very little if any shelly or calcareous matter.

Marl in this wide sense may then be first divided into the two following great classes :

I. Fine *argillo-calcareous earth*, described above as "true marl," and which is not of itself shelly, even when in alternate layers with shells, and contains no separate silicious sand, or other coarse or heavy matters which could not remain, in a finely divided state, suspended in water flowing in but a moderate current. This marl, as stated above, is abundant and rich in some parts of Europe; but so rare and inconsiderable in quantity in eastern Virginia, as to be scarcely worth naming for agricultural use.

II. The second great division is *shell-marl*, which may be again divided into the two kinds, of 1, *recent fresh-water shells*, and 2, *fossil or ancient sea-shells*, left on and covered within what is now high land, up-heaved from the former bottom of the ocean, by ancient convulsions, or other great changes of the level of the earth's surface.

1. The first of these kinds is common in some parts of Scotland, and is found also in Vermont and probably other parts of the northern states, but is not known to exist in Virginia. It is formed by the gradual accumulation of the shells of periwinkles or other small fresh-water shell-fish, at the bottoms of the small and shallow lakes in which the animals had lived. When the bottom had been raised by this accumulation, and by deposites from this and other sources, nearly to the level of the surface of the lake, water plants began to grow, and to form a new accumulation of vegetable and earthy deposites; and finally the lake was thus changed to a peat-bog, wet and miry, but free from standing water. It is under the peat, and sometimes at considerable depths, that this peculiar and very rich marl is found. It is said to be almost pure calcareous matter, and has been sold by the bushel, in great quantity for manure in Scotland.—(*Edinburgh Farmers' Magazine.**)

2. The second is for us the only important division of shell marl, embracing all the immense body of fossil sea-shells which underlies nearly all of the tide-water or tertiary region of Virginia. This is also of two kinds designated by Professor Lyell, according to their geological age and formation, as *miocene* and *eocene*; and these have each the several agricultural varieties and sub-varieties named in the table above, and which will be hereafter described in order.

As the terms "miocene" and "eocene" are now of universal acceptation among scientific writers, and are generally understood by agricultural readers on marl, and therefore are convenient for designating the very different descriptions of marls to which they have been applied, they will be here used. If the difference between these two kinds were merely geological, or in regard to comparative ages of formation, or to the respective fossils of each, it would be useless to preserve it in writing on agriculture, however marked the difference, and however interesting, to the geologist. But there is also a difference of agricultural character and value in these two kinds of marl. In relation merely to each other, the terms *eocene* and *miocene* may be sufficiently understood as the *older* and *newer* formations. But it will not do as well to substitute the latter terms, because they are not correct generally, or in relation to other marls and geological formations. For there are some much older than the *eocene*, and others

* In the Edinburgh Farmers' Magazine, vol. iv. p. 153, there is an interesting article (most of which was republished in the Farmers' Register, vol. i. p. 90,) describing a large body of this kind of shell marl, under Resteneth peat-moss, Forfar, Scotland. Most of the shells are of the water snail (*helix putris*, Linnæus,) others are bivalves, (generally *tellina*, animal *tethys*, Lin.) From this deposite, the proprietor had sold as much for manure as brought him £12,000 sterling, in the 12 years after its use had been begun.

much more recently formed than the *miocene*. With neither of these is it necessary to encumber this article.

The different periods of time of these two different deposites of shells were very remote from each other, and the latest of them was also very remote from the present time. In the miocene marl of Virginia, or later of the two, of the numerous species of shells found, there are but few kinds belonging to animals known or believed to be yet existing; and in the eocene marl of Virginia there are almost none that now exist, and very few that belong also to the miocene marls. According to the highest geological authority, the race of animals whose remains formed the latest of these deposites, were mostly extinct before the creation of man.

Although it might be more conformable to regular or scientific arrangement to commence a general description with the older and lower deposite, the eocene marls, yet it will better suit the purpose of agricultural instruction to reverse the order, by describing first the miocene marls, as the highest in the series and the first reached, and by very far the most abundant and extensively accessible, and which therefore, though usually less powerful for fertilization, are much the most important to agriculture in Virginia in general. I shall therefore proceed first to treat of the miocene marls, which are the only kinds known in Virginia with the exceptions of the two comparatively small districts of eocene marl which will be hereafter treated of in their order.

MIOCENE MARLS.

When my investigations and practical labors on this subject were commenced, more than 24 years ago, the existence of marl of any kind had been noticed in lower Virginia at but a few places, where naturally exposed along steep river banks, and where cut through by deep ravines, and thus rendered conspicuous; and the deposite was supposed to be very limited, by the few persons who had ever cast a thought upon the subject. But the attention and observation subsequently directed to the search, soon showed that the quantity was very far more extensive; and now, though not generally near the surface of the earth, nor every where accessible, it seems probable that beds of fossil shells under-lie much the greater part of all the region between the falls of the rivers and the sea-shore. Except at or near the places where exposed on the surface, as above mentioned, the overlying earth is generally 20 or 30 and even sometimes 50 feet thick. All the marl-beds appear to be nearly horizontal, and of course are the most deeply covered under the highest lands, and are most easily accessible in deep depressions. The deposite dips gently towards the east, so that it lies too deep to be visible near the sea-coast. At Norfolk, the marl has been recently reached, in boring deep for water, at 40 feet below that low surface.

The marl is formed by the deposite and gradual accumulation of sea-shells, mostly left where the animals died; and the vacancies between the shells were filled by the sand or clay, or mixtures of both, with fragments of older shells, brought by currents and deposited in what was then the sea. The remarkably perfect state of preservation of many very thin and always fragile shells, and still more the many pairs of bivalve shells that yet are found connected or in contact, prove that such shells could not have been transported, or even much agitated, by the force of the water. But other beds of marl, and also frequently the upper layers of such as have been just referred to, show as clearly the action of currents, or of water in violent and long continued motion, which served to grind down the shells

to small fragments, and which also left, in shaping the surface of the marl, the marks of whirl-pools or other violent disturbance. From such supposed causes might be expected such effects as many of the various marl-beds actually exhibit. In different places, and sometimes in the same place, the shells and their fragments are found of all sizes, and of all conditions of preservation; and intermixed, in various proportions, with such clay, or fine sand, as might be suspended in or borne by currents; so as to form beds of every degree of texture and shade of color. The shells, and their fragments, or the carbonate of lime, are in various proportions of quantity, from 10 per cent., (or even less in rare cases,) to 90 per cent. or more, of the mixture, or whole mass. In different beds, and sometimes in contiguous layers of the same bed, the shells are in every state of preservation or of decay; from that of being firm, and often entire in their calcareous structure, and the most delicate parts of their beautiful forms preserved, to that of being mostly broken down, and almost reduced to a coarse powder, and sometimes even forming a homogeneous mass of still finer particles in which the forms of but few if any shells are distinguishable. The original bright and various colors of the shells are lost, and they are nearly all white—a few of the hardest only being brown or gray. The texture of the mass also varies, from a loose sand to a firm body of almost stony hardness. The earth intermixed with the shells is generally much more sandy than clayey, and more especially in the poorer marls. Even when the admixture of earth is clay, it rarely makes the marl appear the least clayey in texture, or plastic or adhesive, because the clay is but in small proportion to the shelly matter. The color of the miocene marls is also various—generally either pale yellow or dingy white or blue, sometimes bright, but more often a dull blue, or ash color. The richest marls, of homogeneous texture, are nearly white when dry, and approach in appearance to a coarse or impure chalk. There is no true chalk known to exist in this country.

The shell marls of Virginia are confined almost entirely to the tide-water region, or the space eastward of the granite which forms the falls of all our eastern rivers. But near Petersburg (on the farm of Dr. William J. Dupuy, and other adjoining lands,) there is an exception to this general rule, the marl being found about a mile farther west, over-lapping the eastern part of the granite, and passing under a small stream which empties into the Appomattox, a mile above the lowest falls. A thick stratum has also recently been found in Richmond, above the Penitentiary, and of course above the lower falls of James river.

The only important fertilizing ingredient of the miocene marls is the carbonate of lime, or shelly matter. There may be, and probably is, some slight additional benefit sometimes, by accidental or peculiar admixtures of other substances; as, of animal matter still remaining, or of vegetable extract in blue marls, of the oxide of iron, of a small proportion of greensand generally, and even of the clay or the sand respectively for soils deficient in either. But either and all of these additional matters, though giving some value as manure, are of but little importance in miocene marls, in comparison to the main and great agent of fertilization, the shelly or calcareous matter. According then to the greater or less proportion of this main ingredient, and to its state of division or readiness to be reduced to a state of minute division in the soil, may be rated the comparative values of marls for manure. In regard to the much larger proportions of greensand in miocene marls, as asserted by other authority, some additional remarks will be hereafter submitted, in the proper order for consideration.

As might be inferred from the obvious manner of the deposition of the marl, as before stated, by waters of the sea in violent and yet varying

degrees of motion, the different horizontal layers of marl, successively deposited in the same bed, and even within a few inches of perpendicular distance of each other, sometimes exhibit remarkable differences of appearance, composition, and of value; while there is also generally as remarkable a uniformity of character of each particular layer, (though differing much in thickness at different places) throughout not only the different diggings of the same place, but sometimes for miles in extent. I have seen often, in diggings on different farms, and several miles apart, layers of marl so precisely alike, and so marked in peculiar character, that there could be no doubt of their being parts of the same deposite, made at the same time, and by the same operating natural causes. Under such circumstances, a practised eye can by comparison fix very nearly the chemical composition of similar varieties, and even more correctly, for general averages of value, than would be usually obtained from the accurate chemical analysis of one or two specimens For the usual danger of error is, not in the chemical analysis, (which is easy enough made, and the mode very correct,) but in the selection of equal and fair specimens of marl to exhibit the average strength of the whole body excavated; which requires much more experience and accuracy than are usually exercised by most operators, and still more in regard to proprietors who send specimens of their marls to be analyzed by other persons. It is highly important to the farmer to know the strength of the marl he is using. And to this end, it is necessary that every layer should be carefully analyzed, or what is better, a specimen from an equal and continuous shaving of the whole vertical section of a digging, so as to furnish a fair average of the whole body. But after this trouble is once taken, the general result will serve for all the future diggings at the same place, and also for similar bodies more or less remote.

The layers of marls formed by shells left "in place," or where the animals died, are in general the poorest; and for this obvious reason, that all the hollows of and interstices between the shells are filled by what is mostly earth, (but mixed with more or less of shelly fragments,) and that earth is principally silicious sand. Marl so formed, will not have more than 35 to at most 40 per cent of calcareous matter, and more often only from 25 to 35. The sand or earth that would be required to fill all the hollows and chinks of a body of entire shells, of ordinary form, though touching each other at their edges and points, would necessarily be as much as 65 to 75 per cent. of the whole mass. And therefore, it is only because of, and in proportion to, the quantity of shelly particles mixed and borne along with the earth brought by currents and deposited among the whole shells, that such marl is sometimes richer than 25 to 35 per cent. in calcareous matter. The degree of admixture of shelly fragments in this filling earth, may be easily judged of by an experienced eye, and the proportion of shells and large fragments will depend much on the forms of the prevailing kinds of shells. It is easy to know the marls formed by shells left in their original place, by the state of the shells. Either the shells being whole, and especially the more fragile varieties, or the two sides of bivalve shells being found in close contact, as when the animal was living, will show clearly that the dead shells had not been agitated or borne along by currents. The beds or layers formed by removal are as easily known by the broken and finely reduced state of the shells. These marls are usually much the richest in calcareous matter; for, by the grinding operation of the currents, and the difference of specific gravity in the particles carried along, the calcareous powder and clay are deposited together, with but little silicious sand. Among the richest marls are some having whole shells in their original places, but of which the interstices are filled by such fine calcareous and clayey earth as could have been deposited only in waters nearly still. Such are

the rich marls in and about Williamsburg, and in Surry and that belt of country generally, containing 70 to 80 per cent. of carbonate of lime.

The different varieties of miocene marls which will now be more particularly described are not always separated in different beds, but sometimes form some of the different and even adjoining layers of the same bed or digging. The differences of color, &c., caused by the greater or less quantity of various accidental ingredients, however striking to the eye, are not often of much importance to the value of the marl; but only (or principally) such differences as are caused by the greater or less proportion of shelly matter, and its state of disintegration and division.

(*a*) *Yellow marl.*—This kind, wherever found, always forms the highest layers of the particular body. That is, if there be layers both of yellow and blue marl in the same body, the yellow is always above and the blue below, and never in the reverse position. But sometimes the yellow continues to the bottom, and sometimes the blue forms the top as well as the bottom.

Yellow marl is usually found dry; that is, having no springs or oozing waters, which are generally reached on digging lower in the body. But the lower part, where wet, is sometimes, though rarely, of the same yellowish or dingy white tint, so as to make it manifest that the color is not dependent on the degree of moisture or dryness. The yellowish tint is owing to the presence of oxide of iron, and is pale or deep, approaching sometimes to reddish brown, according to the quantity of that coloring matter.

Yellow sandy marl is the kind most abundant in Prince George county on and at some miles distance from the banks of James river, and from which some farms entirely, and others principally, in that neighborhood have been marled. It is of shells left in their original place, the filling earth being mostly of coarse sand, and the whole body poor in calcareous matter, varying in its proportion usually from 20 to 30 per cent. and rarely richer than 35 per cent. But it is of such open and loose texture, (and the more so as the sand is the more abundant,) that this marl is easily and cheaply worked, and the labor so applied is therefore often better compensated than in diggings of much richer marl. In this variety of marl, the shells are usually entire, or in large fragments, but are not firm or well preserved. In some beds, or thick layers, they are so finely reduced that the mass seems to the eye to be wholly, as it is indeed principally, a body of silicious sand. From one bed of this kind which its proprietor supposed from its appearance to be merely silicious, it was used as sand to mix in lime mortar for masonry, and it was found to serve well for that purpose. Subsequently this bed of sand was found to be enough calcareous to be used as manure; and was so used, and to such good profit, that the proprietor supposed it to be rich marl. In that opinion, however, he was mistaken, at least as to the calcareous contents.

Yellow clay marl.—But most of the richest as well as of the poorest miocene marls are yellowish. When rich, say containing proportions of carbonate of lime from 45 to 80 per cent., the marl is usually formed of shells broken down, when under the sea, to small fragments or to powder, by the grinding action of the water in violent motion, and left afterwards to settle in stiller water, according to the specific gravity. Or it is the same kind of rich and finely divided water-borne matter deposited on and filling the hollows in and between whole shells remaining in their original place. In either case, the small quantity of earth first suspended in the current, and then deposited with the finely reduced shelly matter, is mostly if not entirely clay; as silicious sand, having more specific weight, could not be suspended by

the current so long, or carried so far, before being deposited. The few rich clay marls of Prince George are of the first named variety, or composed entirely of fine fragments of shells intermixed with clay. The much richer marls in and about Williamsburg are of the other kind, there being also numerous whole shells in place, as well as the interstices being filled almost entirely by water-borne fragments, and fine powder of other shells. The other contents, making from 15 to 25 per cent. of the body, are principally of a very fine clay of pale yellow, and much less of silicious or white quartz sand, oxide of iron, and green-sand. Much of the same kind of rich marl is also in other parts of James City and York, in the lower part of Surry, and in Isle of Wight, New Kent, and King William counties, which I have seen—and probably throughout the middle belt of the marl region of Virginia. There has been little or none of these rich clay marls seen by me in the upper range of marl counties, (those next the falls of the rivers,) and not much more near to the eastern limits, or next to where the marl dips so deeply, as to disappear from the surface and is accessible only by deep digging. Perhaps observations more extended, and more accurate than mine have been, might present different conclusions.

The marls just described, when separated mechanically, (by the sieve and by carefully washing in water,) seem to consist, for the much greater part, of pure shelly matter, mostly in large or small fragments, slightly colored by brown oxide of iron, and the remainder of a very fine and apparently pure pale yellow clay. But this clay is also composed in part of finely divided carbonate of lime; and the fine shelly matter is intermixed with some silicious sand and a little green-sand. The bed of marl near Surry Court House, (which is similar to the marl at most other places thereabout,) is of this kind and general character; and from it, a large body of land has been manured with great benefit. This body of marl was reputed to be among the richest in green-sand. From a much larger sample of the marl of this bed, carefully selected by the proprietor, at my request and for my examination, an average portion taken was composed as follows:

1780 grains, separated mechanically, by the sieve and by washing in —— water, consisted of

	Carbonate of lime.	Fine argillaceous earth.	Silicious sand.	Green sand.
1036 grains of shells and coarse fragments, nearly pure, and so counted,	1036			
433 grains fine shelly fragments, &c., which consisted of - - -	268	- - -	120	45
277 grains fine yellow clay, &c., which consisted of - - -	65	- 212		
34 loss in the process.				
1780	1369	212	120	45

Which may be stated of parts to the hundred thus:

100 grains of marl contained of carbonate of lime,	77 grains.
Silicious or quartz sand, very pure and white,	$6\frac{3}{4}$ "
Green-sand - - - - - - - - -	$2\frac{1}{2}$ "
Fine yellow clay or argillaceous earth, (and the loss in the latter process,) - - - - - - - - -	$13\frac{3}{4}$ "
	100 "

The richest bodies of these marls show very few shells, or even fragments, and have a homogeneous texture and appearance to the eye, like a very impure chalk or sandy clay. Such marls are in James City, New Kent, King William and Middlesex counties. The following are some of them of which I have analyzed specimens:

From King William, (Lipscomb's land)—82 per cent. of carbonate of lime.
" " (Slaughter's land)—88 " " "
" New Kent, (Col. Macon's land)—88 " " "
Middlesex, (Oaks' land) - 83 " " "

Some of very similar appearance, but still more approaching in texture to a very soft rock, from Lenoir county, N. C., and the bank of Neuse river, contained 75 per cent. of carbonate of lime. Sundry other specimens, of still more homogeneous and firm texture, from the banks of the Santee, S. C., contained about 95 per cent. Most of these marls are soft enough to be used for manure as dug from the pits; but the hardest lumps may need burning to lime. Any hard enough to need burning, and as rich as 85 per cent., will make good lime for cement, as well as for manure.

Under a peculiar combination of circumstances, the great richness of some marls operates to lessen the value of the body as manure. Rain water, when just fallen, always contains some carbonic acid, which admixture causes it to be a solvent of carbonate of lime. When rain water then can descend by percolation into rich dry marl, in its passage it dissolves some of the calcareous matter, which is again left solid, and in crystals, by the slow evaporation of the fluid. These crystals of carbonate of lime are slowly added to by every recurrence of the like causes, until the cavities of large shells, and other openings into which the water had settled, are completely filled with crystallization. If layers of marl, less pervious to water than in general, oppose the descent of the water, the crystallization forms in connected horizontal layers, separated by the thicker layers of softer marl. Such crystallized layers are found abundantly in the very rich marl at Yorktown, serving by their stony hardness to impair the otherwise great value of the manure. At Bellfield, Col. Robert McCandlish's farm, a few miles higher on York river, the hollows of large shells have been filled with beautiful and brilliant crystals thus formed. In Surry also, on the land of the late William Jones, such crystallization is abundant. For such effect to be produced, there are several conditions necessary. The superincumbent earth must be of open texture, and not very thick—or rain water could not pass through. It must not be a hill-side—as the water would flow off the surface and not penetrate to the marl. And the marl must be dry—or evaporation could not take place, and of course not crystallization.

Gloucester, though one of the outside marl counties to the east, is most abundantly supplied with marl, accessible on almost every farm, whether of high or of low grounds. It is generally of the poorer yellow kind. But three marked exceptions were seen, which as such deserve to be named. One is the rich clay marl forming the north bank of Ware river on the farm of Mr. Alexander Taliaferro. Another is the general sub-soil (as it may considered from its position) of the lowest land of the farm of Mr. Jefferson Sinclair, near the mouth of Severn river. This is an almost pure body of coarse shelly powder, or fragments, seldom found larger than two or three grains in weight, and a very few shells, of as minute size, entire enough to be distinguished. This mass of shelly matter is as loose and incohesive as coarse sand, yet is tinged slightly with green by the admixture of greenish clay. A specimen analyzed contained 72 per cent. of carbonate of lime. (See more full account at page 181, vol. vi. Farmers' Register.) The third is the marl used by Capt. P. E. Tabb, and dug from beneath the low grounds on North river. It is a mass of pulverized shells, colored by red or brown oxide of iron.

(*b*) *Blue marl.*— This is the most common kind in the upper range, or near the western limits of the great marl deposite. Thereabouts, blue marl usually forms the whole thickness of the bed. More eastward, and lower

down the country, it sometimes forms the whole of low-lying beds, but more usually only the lower layers of a bed, of which the upper part is yellow.

Blue marl is generally such as remains "in place," or where the shells were left by the death of the enclosed animals, and the intermixed earth is mostly silicious sand; and therefore, (and not because of its color,) this marl is rarely found as rich as 45 per cent., and is still more rarely equal to the yellow clay marls, though generally richer than the yellow sandy marls.

Blue marl in the bed is always wet, being made so by water slowly oozing from every part, though seldom fast any where, or showing springs or veins of running water. The blue color is not caused by moisture, (for some yellow marls are also permanently wet,) but by vegetable extract, or other dark-colored putrescent matter, brought in the percolating water. This inference I have drawn from extensive observation of the natural beds, and also from several accurate though accidental experiments, of which the first that was observed will be here stated. A small stable yard was covered 6 to 10 inches thick with a rich dry yellow marl, for the purpose of retaining by chemical combination the juices of the putrescent manure which was to be thrown there from the stable. After remaining for this use a year or more, this flooring of marl was dug up and carried out for manure; when it was found to be changed in color to a deep and vivid blue, and precisely like the natural color and appearance of the under-stratum of the same body of marl, which being an open and almost pure mass of pulverized (and water-borne) fragments of shells, was readily penetrated by and always full of water. A general fact confirming this view is that all marls found lying immediately under swampy soils, full of vegetable matter, are blue. And this coloring vegetable matter in marl is not merely intermixed with, but must be held in chemical combination by the calcareous matter; and serves, according to its quantity, in blue marls, as an an addition to the fertilizing power of the calcareous matter alone. The particular body of marl above referred to, the under-stratum of which is the most marked or vivid blue ever seen in marl, is at Shellbanks farm, Prince George, and from which I dug and applied a large quantity. The greater part, and all the richest layers seemed to be of shells broken down to a coarse powder, or of sizes less than fine gravel, through which clear water rose and passed so freely as to forbid digging to the bottom. The small quantity of clay or other earth intermixed with the calcareous earth of this marl is altogether insufficient to hold so much coloring matter; and, moreover, if the coloring matter were not *chemically* combined with the calcareous, the continued free passage of water must have dissolved and washed off any uncombined vegetable extract. This whole body of marl, both the dry and yellow lying at top, as well as the blue and wet below, was all brought and deposited by currents, as is manifest by the different layers of different specific gravity, and still more by the many intervening layers of a fine calcareous clay, (before mentioned,) which may be considered as the true marl of mineralogists, though in very small quantity. Analyses were carefully made of every different quality, and the results may be interesting as showing how much one layer may vary from the one next adjoining; and different specimens not more than a few inches apart.

Upper dry part, yellow, and loose as sand, varying (by unevenness of surface) from 3 to 7 feet, contained of carbonate of lime -	53	per cent.
Next layer below, brownish yellow, through which water passes, - - - - - - - -	25	"
About 12 inches lower, in the blue, - - - -	64	"
" " " " " another specimen below	69	"
Layers of clay marl, interspersed through the above -	9	"

And in a subsequent digging the strength of four specimens of the blue part of the marl was as follows:

In the first foot depth of blue under-stratum	32 per cent.
In the second foot	33 "
At 3½ feet	76 "
At 4 feet, and lowest digging then effected	70 "

It may readily be inferred, from these various results, that if one or two specimens only had been analyzed, and these taken with no more care than is commonly used, that a very deceptious report might have been furnished from making even the most accurate analyses.

Conchologists and geologists, who have treated so much of marls but merely in reference to the shells they furnish, or to their geological character, speak of the blue marl as formed by shells being imbedded in a *blue clay.* But the earth is not generally a clay, nor any thing even approaching to a clay, but is mostly of silicious sand. The ordinary blue marl contains usually from three to four times as much pure silicious sand as of clay. From various specimens of two diggings in such marl, from which more than 300 acres were marled of the Coggins' Point farm, the following results were found by analysis:

Yellow marl (wet) thin layer at top, contained of carbonate of lime 24 grains.

Within 24 inches of top, shelly matter finely divided, and the mass uniform dull blue color, 100 grains contained:

Carbonate of lime,	34 grains.
White silicious sand,	47
Clay, black when moist, and dark gray when dried,	19
	100

Like blue marl from another pit in the same body, 100 grains contained:

Carbonate of lime,	34 grains.
Silicious sand,	52
Clay,	14
	100

Of another specimen from the same, and of similar marl, 100 grains contained of carbonate of lime	29
At 6 feet deep, (the shell not much reduced,) carbonate of lime	44
At 13 feet deep, and one foot from bottom,	33
Some few hard lumps of conglomerated shells and earths scattered through the general mass,	73

From a digging at three-fourths of a mile distant, of marl of the same appearance and believed to be the same body as the preceding, the general average of strength, as obtained from several trials at different depths, was in 100 grains of marl, 35 of carbonate of lime. The thickness of this body, where penetrated, varied from 11 to 14 feet; where there was a marked though not entire absence of shelly matter, and increase of silicious sand of the same blue tint. The deeper removal was stopped because of the obvious poverty, and no further examination of more than a foot or two in depth was made in this poor substratum. In but few of all the various diggings made by myself, or of others heard of, has the bottom of the marl been reached—though in many, and most generally when penetrated deeply enough, it becomes so poor as to be not worth the labor of removing. In the only known cases, when digging the marl for manure, that the bottom of the miocene was reached, the stratum below was of eocene green-sand earth, or eocene marl. In digging a well, at Shellbanks in Prince George county, my then residence, after passing through a bed of firm blue marl,

of broken (or water-worn) shells, obviously the same kind dug at another place for manure, and described at page 204, a soft brown sand was reached, apparently destitute of calcareous matter, and from which rose an abundant supply of pure and soft water to the height of 13 feet, which stood altogether in this blue marl, without its purity being affected either by the calcareous matter of the marl, or its coloring matter. The continued purity of this water is an additional proof that the blue coloring matter is chemically combined with the carbonate of lime—and the combination is a visible illustration of the manner in which marl holds to and fixes putrescent manures.

Mr. William Carmichael, of Queen Ann's county, Maryland, an intelligent agriculturist and an experienced and observant marler, is of opinion that there is a perceptible superiority of effect of blue marls over others of equal (and even greater) strength in calcareous matter. (Farmers' Register, vol. vii. p. 106.) This superiority of effect must be caused by the vegetable or other putrescent and alimentary matter being combined with the calcareous, and by its presence giving color to the blue marl. And that the blue color is thus produced is fully proved by the facts stated at page 204, and by my more general observation.

Excepting then the additional value in the vegetable extract which gives the color, there is no difference between the blue and the yellow marls, other than the difference, as of any marls of similar color, in their respective amounts of calcareous matter. And the same may be said of wet and dry marls, which are generally, but not always, distinguished by the above colors; and also of any other miocene marls, excepting for such proportion of "green-sand" as is sometimes present. But there is reason to believe that wet marls, in many cases, have lost some of their ancient strength, by the continued though very slow percolation and subsequent discharge of water through the mass. If recent rain water penetrates wet marl, it dissolves some carbonate of lime, (by means of the carbonic acid in the rain-water;) and, as the water slowly flows off, or oozes out, instead of being evaporated, the dissolved lime is washed into the nearest stream, and is lost, instead of being left, crystallized or otherwise, as in dry marl. Again—if water flows over having sulphate of iron (copperas) in solution, (which is not a very rare case,) that dissolved salt acts with the carbonate of lime to produce the decomposition of both the sulphate of iron and the carbonate of lime, and from two of their component parts to form sulphate of lime. And as this is slightly soluble in water, it must be carried off by the slowly oozing water, as long as any of these new salts remain. In this case, the carbonic acid is evolved, and the iron is precipitated—and often fills, or coats the interior of the spaces before filled by the shells which this chemical process had decomposed and removed. This effect, when produced, is seen at the upper part of the marl, where the copperas water first touches the shelly matter. In Henrico, near the western limit of the marl, there is generally over the present highest shells a body of earth of color and general appearance very similar to the marl below, and full of hollow impressions of shells, though no shelly nor even any calcareous matter now remains. In other marls, there is often seen an upper layer colored brown by this deposite of iron. Both these are different modes of the same operation; the waters charged with sulphate of iron having in the latter case decomposed and removed but part, and in the former all the calcareous matter, to some depth below the former top of the stratum of marl. The marl, in the upper part of which the shells have been thus dissolved and removed, has a decided sulphureous odor, which is left very perceptible on the hands, after handling the marl as dug; and this odor is still more

manifest in the marl when it has been dug and thrown out, and exposed some days to the weather. Such marl is within a few miles of Richmond, at Dr. Chamberlayne's and Col. C. W. Gooch's farms. It is poor in calcareous matter.

The comparative values of marls are fixed by the comparative proportions of carbonate of lime contained, other circumstances being alike; yet if these circumstances are very different, they may make a marl containing but 25 per cent. worth more than another of 50 per cent. The more finely reduced, or the more rotten the shells, the quicker the action will be, and the more profitable the marling. But all the white shells, however hard and entire when applied, are dissolved in a few years, if the soil really needs so much lime—that is, (according to my views,) if there be *acid of soil* enough to combine with the lime. But the brown or slate-colored shells seem to be insoluble and almost indestructible, and do very little good as manure. These shells are the several species of scallop (*pecten*) and of fossil oyster, (*ostrea*,) and some few others, all fortunately being but in small proportion to the numerous white and softer shells.' Some beds of marl, however, or layers, have mostly these hard shells, and therefore are worth very little compared to what their chemical analysis would indicate.

A list of most of the shells found in the miocene marls, and also of the eocene of Virginia, (and of which specimens are in my collection,) will be annexed to this article, for which I am indebted to the scientific knowledge and kind assistance of Mr. M. Tuomey. But as the scientific names will be of but little use to many readers, it may be useful to describe in advance a few of the most common shells, peculiar to the miocene marls, and which can scarcely be mistaken. Such are the various large scallop shells, (*pecten*,) oysters, (*ostrea Virginica, &c.*)—hollow tubes, about the thickness of a large pipe-stem, and open at both ends, (*serpula*,) and eliptical funnel-shaped shells having a small hole at the bottom, (*fissurella*.) These references will be enough for any person acquainted with the shells by sight, but not acquainted with their scientific names. If however even very slightly informed in the latter respect, the observer will not need any such explanations.

It is not necessary to speak otherwise than very concisely as to the practical applications and effects of miocene shell marl; for this is the kind in general use throughout lower Virginia and Maryland and to such small extent as has been used in North Carolina, and therefore the operation is well known. All the usual and general and highly beneficial effects of marl known, with but few exceptions in the limited districts of eocene marl, (hereafter to be described,) are due to the miocene marls. And of such effects, there have been numerous statements, general and particular. The operation of the eocene marls, and especially those largely mixed with "green-sand," is different, and superior; but their use has been so limited, and so few statements of effects published, that nearly all the particular results and general statements of effects yet laid before the public, in the 'Essay on Calcareous Manures' or elsewhere, have been in relation to the miocene marls.

EOCENE MARL.

(c)—*Calcareous marl, containing but little green-sand.*—The existence in Virginia of the marl now known as *eocene*, was first discovered in 1819 by myself. in the south bank of James river, underlying the promontory of Coggins Point; and in the same year it was tried as manure. The texture and general appearance of this marl were obvious-

ly peculiar; and its effects as manure were soon also observed to be in some measure different from those of the other marls, which I had then used, and which were all of the kind now distinguished as miocene. At that time these terms had not been introduced, and for perhaps fifteen years afterwards, I did not so much as hear of the terms "eocene" and "miocene;" but their difference of age, appearance, and agricultural character were not therefore the less evident and obvious to my observation. The manifest difference of effects as manures was then ascribed by me to the general if not universal presence of a small proportion of sulphate of lime, or gypsum, in the eocene marl. The belief in the general presence of gypsum was very early induced by my seeing in a few places small crystals overlying and in contact with the surface of the bed of marl; and also by the apparent results of such poor attempts as I subsequently made to ascertain the presence of this substance, by means of chemical tests. Upon such imperfect tests, and to the still more imperfect knowledge and skill which I could apply to the investigation, (amounting indeed to almost nothing,) very little reliance ought to have been placed. Nevertheless, I thence inferred that there was universally present and diffused through the body of this marl a small proportion of sulphate of lime, (say one or two parts in the hundred,) and subsequent agricultural practice has supplied the confirmation, which has not yet been sought for by the superior chemical knowledge and skill of any other and late investigator. In the earliest publication of my views on calcareous manures in 1821, the *gypseous* character of this particular body of marl was affirmed, and the peculiar character of the results of the first experiments with it stated.* And in the edition of 1832 of the 'Essay on Calcareous Manures,' the general and full description of this marl was given precisely as it now stands in pages 92 and 93 of the latest edition. My still earlier discovery of and observations upon the peculiar character of the underlying bed of *gypseous* or "*green-sand*" *earth*, (which will be treated of subsequently,) led me to observe the peculiarities of the eocene marl, which being less distinctly marked, might otherwise have escaped my notice.

As stated above, it was not from any knowledge of geological theories of successive formations, and different ages and periods, of all which I was profoundly ignorant, that my opinion of the peculiar character of this marl was influenced. But judging solely from the more rotten and disintegrated state of the shells, and their entire disappearance generally, even though their calcareous material remains—and from the total difference of kind of the few shells remaining whole, or of which the shape is distinctly marked, from any others of the many shells then known to me in any other marls, I very early formed the opinion that this bed was one of the remains or ruins of a condition of the earth much more ancient than that in which the ordinary marls had been formed. I remember having stated this opinion to one of the earliest of the several geologists who at different times visited my dwelling place and my marl excavations. This was the since notorious Mr. Featherstonhaugh, to whom I pointed out this curious and to me highly interesting deposite, and requested his attention to the more modern and very different (miocene) marl lying immediately upon and in close contact with the much more ancient formation below. This remarkable feature I also showed at a later time to Professor William B. Rogers, who was much struck with the fact, and attached so much impor-

* American Farmer, vol. iii., p. 317, and also the same experiments numbered 18, 19, 20, of the present edition of 'Essay on Calcareous Manures.'

tance to it, that he has referred to it in several of his subsequent publications.

The most ready and certain mode of distinguishing eocene marl, is by reference to some of the shells belonging to this kind, and which are never found in miocene marls. There are many such; but the most common and well marked are the two following: 1st, the *cardita planicosta*, a bivalve white shell, having numerous regularly formed ridges running from the point at the hinge of the valves to the circumference of the outer or opening parts, and widening as the ridges extend—both valves alike, and having outlines approaching to circular—sometimes seen more than three inches across and the connected valves nearly two inches through, but generally of much smaller and various sizes. 2d. The *ostrea sellæformis*, or saddle oyster, a curiously and variously contorted brown and very hard bivalve shell, the larger valve of which approaches the shape and reversed curves of a saddle. This shell is sometimes found more than five inches in length. Both of these shells are abundant, especially the *cardita planicosta*, in this particular bed of eocene marl, and also in the upper part of all the other eocene marls since known elsewhere in Virginia. Without reference to these, or to some other characteristic shells, the eocene marl might not always be distinguishable by its texture or general appearance from the miocene. And even these two shells, the most abundant and characteristic of the eocene formation generally, are neither to be found in the lower layers.

For some years after the first discovery and application of this calcareous eocene marl on Coggins Point farm, it was not known to exist elsewhere. For even where then visible, and at later times used, its different character was neither known nor suspected by its proprietors. As chance furnished to me opportunities of seeing the beds, or as small specimens of the marl were sent to me for examination, I gradually came to know the greater extent of this bed. It is now known at various points in an area of about twelve miles in length, from east to west, and eight or ten miles wide, which area takes in parts of the counties of Prince George, (which has much the larger portion,) Charles City, and the lower point of Chesterfield. And in this area also is the broad bed of James river, and the lower parts of its considerable tributaries, Appomattox river, and Bailey's, Powell's, and Herring creeks. The marl is exposed to view on the southern side of James river, at the following several points: Coggins Point, Maycox, (a mile below, and the most eastern exposure known,) Tarbay, Wm. H. Harrison's farm, and Beaver Castle, all above on the river—Eelbank and Hawksnest, (the most southern exposure,) on Powell's creek—the Old Court-house tract and Spring Garden farm, both on Bailey's creek, and the latter from one to two miles above the head of its tide, and three miles south of the Appomattox where opposite. The last is the most western exposure. On the northern side of the Appomattox, it is seen in the river bank at Bermuda Hundred, and north of James river, and of Herring creek, at Neston and Evelynton.

Through nearly all this large area, this bed of marl preserves remarkable uniformity of appearance, texture, chemical character and composition, and even of the thickness of the stratum, and of the succession and variations of character of the several smaller layers of the general body. The bed lies nearly horizontal, but dips slightly and irregularly eastward and northward. At Coggins Point, its lower part is 10 to 12 feet above high tide, while at Maycox, a mile to the east, and at Evelynton three miles north, it is lower than high tide mark. Yet not so much difference of elevation as this is seen in all the greater extension westward to Bermuda Hundred. The stratum varies from 4 feet to 10 feet thick, being thinnest

at its south-western extremity, Spring Garden, and thickest at the north-eastern, Neston and Evelynton. At Coggins Point, where traced along the face of the river cliff continuously for more than half a mile, it is usually six feet thick, never more than eight, and never less than four feet, except where terminating. The general and almost uniform color is a pale dingy yellow. The few shells remaining are not perceptible without careful observation, and the whole mass, when dug down for use, is scarcely distinguishable from many common and barren sub-soils, or clay river cliffs, of like color. Two thin but continuous and separate layers of almost stony hardness extend through the whole bed. These contain from 85 to 90 per cent. of carbonate of lime, and may be burnt to excellent quick-lime for cement. The marl intervening with these hard layers is similar to them in color and general appearance; but is quite soft and mellow in handling, and in that respect differs from all other known marls. The very uniform calcareous proportion of this part is about 53 per cent.; and taking an equal section of the whole thickness of the bed, and with the greatest care to obtain a fair average sample, the strength in carbonate of lime was found to be 62 per cent. This is far less of calcareous matter than is contained by many miocene marls which show less effect than this as manure. But besides its calcareous matter, this eocene marl has some little gypsum, some kind of saline matter which cattle are fond of licking, (believed to be sulphate of alumina,) and some amount of the granules of "green-sand"—and more of this than most of the miocene marls. The other earth of this marl is mostly of yellowish clay, and composed more of argillaceous than silicious matter. I confess that all these additional ingredients, together, do not seem to me sufficient to account for the superiority which this marl exhibits as manure.

Though this peculiar kind of marl was so early known, and its value appreciated, and, though it underlies the whole of Coggins Point, yet it is covered there so deeply by the overlying earth, and is therefore so difficult to work extensively, and, moreover, is so distant from the main body of the farm, that this has not been applied to more than 65 acres, out of some 700 marled on that farm. Other proprietors have elsewhere made much more extensive applications of this marl. The peculiar effects of this kind of marl were tested with the most accuracy by Messrs. Collier H. Minge, then of Walnut Hill, and Hill Carter, of Shirley; both of whom used this marl from Coggins Point, water-borne to distances of 12 and 15 miles. Though the marl was given to them, (in the bed.) it was yet very costly in the labor of digging and transportation; and therefore they used it with strict economy, and carefully estimated the results. But highly as they both thought of, and have reported the effects,* in comparison with either lime or miocene marls, the expense and trouble were so great, that it is now considered by the most judicious farmers on the tide water rivers, that they can better afford to buy stone-lime, at its present low price, (8 to 10 cents the bushel,) than to transport marl of any kind by water

Since the foregoing pages were written, I have learned of two farther exposures of this body of eocene marl. One is four miles north of Evelynton, (in Charles City county,) where the marl was reached and penetrated by the digging of a well in 1814. At about 30 feet deep, after passing through the marl, and a layer of rock, water was reached, which rose to the top of the well, and continues to flow over, forming the only Artesian well known in this region. The other locality is in Henrico county, on Turkey Island creek, its eastern boundary, and about 8 miles

* See Farmers' Register, vol. v., pp. 189, 247, 511.

north of City Point. This marl I recognized to be the same, by a specimen recently brought me for examination. It is below the surface of swampy ground, and is colored dark gray. It is much fuller of green-sand, and indeed in that respect makes some approach to the green-sand marls of the Pamunkey, of which the nearest exposure is only 16 miles from this place. It is probable that the marl extends continuously from the one place to the other, and may be found throughout the interval by deep digging.

(*e*) THE GYPSEOUS EARTH OR GREEN EARTH OF JAMES RIVER.

Before proceeding to consider the next and only remaining known variety of our marls, the eocene green-sand marl, it is necessary to treat in advance and separately of the peculiar earthy compound, called "green-sand" by geological writers, of which the large admixture, and sometimes even larger proportion, gives additional value and peculiar character and action to the greater number and quantity of the eocene marls yet known. But important and valuable as may be the green-sand in itself, and necessary to be considered in connexion with the subject of eocene marl, with which it is so inseparably connected, I wish especially to avoid confounding the two earths under one name or one character; and to be understood as protesting against the prevalent error, in giving currency to which scientific writers have concurred with the unlearned cultivators, of applying to the non-calcareous green-sand earth the name of "marl," and thus adding another, and the most important one, to the previous misapplications of this wonderfully misused and misunderstood term. This misapplication is universal in New Jersey, where the green-sand earth is most abundant, and is generally very rich in its distinguishing ingredient, (usually containing 75 to 90 per cent. of pure green-sand—) and where this earth has been long, and is now extensively used as a manure, and has been found to be of great value as a fertilizer. I shall hereafter refer to both the points of resemblance and of difference (both of which are important and interesting) between this green earth of New Jersey and that of James river; but, for the present, my remarks will be confined to the latter, and its use as manure, as known principally, and indeed almost entirely, from my own observations and practical experience, there having as yet been but few trials of it made by other persons.

It was mentioned in the foregoing section, that the first notice or observation of the eocene marl on James river was induced by the previous discovery and examination of the green or gypseous earth—the latter being the universal underlying bed of the former, and connected with it in more respects than merely its subjacent position. It was my chance, or the result of habits of observation of marls and other earths, and not of any scientific knowledge or previous preparation for such investigations, which led me, in 1817, to be the first to observe this bed of green earth in the river banks of Evergreen and Coggins Point, and to trace it where visible along the intermediate ground, a distance of about eight miles. Since then, it is known to be much more extended; for it not only underlies all the eocene marl of the same neighborhood, wherever that is found, and part of the yellow sandy miocene, but also extends beyond, and is found at various places where no eocene or even miocene marl is found. The most western limit, seen after a long interval or concealed existence of this formation, is at Petersburg, where it shows in the ravines south of Poplar Lawn.

What first directed my attention to this earth was the existence in the

river bank at Evergreen, (the place of my birth, and of residence in early life,) of curiously shaped and beautiful crystals, which subsequently I learned were selenite or gypsum. The like crystals, though much smaller in size, I soon after found in different places at Coggins Point, my own farm and then residence. And, in making examinations for this purpose, I observed that wherever any gypsum could be found, it was always in a peculiar kind of earth, which, though varying much in appearance in different places and at different elevations at the same place, yet possessed characteristic marks by which it could be easily distinguished from all others. This was the earth in question. For want of any known or more appropriate name, I at first applied the term "gypseous earth" to this deposite; and though I subsequently abandoned this name in (undeserved) deference to scientific authority, and have used instead, in my later publications, the name "green-sand earth," I now believe that my original term (in reference to the more general and universal manuring qualities) was the better of the two, for reasons which will appear in the course of these remarks. And besides that "green-sand earth" is inconvenient for its length, it is not truly descriptive; for the entire granules from which the peculiar character of the earth is derived, are not green, but black superficially, or so appear; and are not what is usually understood as *sand*, but in texture are like fine and unctuous clay. Still worse is it to term the whole mass, "green-sand," as is usually done, when the pure "green-sand," even if that were properly named, may not form one fourth or even one tenth of the whole mass of earth. I therefore would prefer for the deposite, and shall use indifferently, either my first designation of gypseous earth, or the name of *green earth*, which latter is convenient, is sufficiently descriptive, and moreover affirms nothing except as to the color, which is generally manifest in the whole mass, and, if not, is certainly so in the separated and mashed granules, which distinguish the earth.

As the lower part of the river bank is mostly exposed and kept bare by the frequent washing by the waves driven by strong winds and high tides, the bed of gypseous earth can be easily traced through nearly its whole course along the river side. As thus exposed to view, it has generally a green color, most frequently intermixed and mottled with smaller streaks and spots of bright yellow. The earth, as seen firm in the bank, and with a smooth washed surface, might be supposed to be somewhat of a clay; but, on handling it, and breaking down a lump, its texture is more like sand, as indeed a large proportion of the mass is silicious sand. A very general distinguishing mark of this earth is its containing numerous hollow impressions of eocene shells, of which the forms remain perfect, though neither the shells themselves nor any portion of their calcareous substance remain, as the earth in this part, and where most generally seen, contains not a particle of carbonate of lime. Among the yellow spots there are also other small spots and streaks of reddish brown colored clay, very pure, soft and unctuous to the touch. The bright yellow clay is doubtless largely impregnated with iron, or is a true yellow ochre. Though soft within the bed, this yellow ochre hardens when exposed to the air on the outside, and even when under water. Many of the yellow spots made by this ochre, as seen on the surface of a smooth section of the bed, have a rough resemblance to the shape of sections of bivalve shells; and these contrasted with the general green ground, and, with the exception of the colors being different, give to such a section of the bank somewhat the appearance of the beautiful black marbles used sometimes for mantel-pieces, in which the white traces of what were formerly shells show throughout. In some places near to and below the beach, the earth is seen much darker colored, indeed is

almost black when moist in the bank, though more of dark green when dry. This deeper color is owing to the green granules being present in larger quantity; and generally, if not always, the lower part of the bed of earth is richer in that ingredient than the upper. The empty impressions which were formerly filled by shells are still found in penetrating below; but as the depth increases, first are seen some fragments, and then whole shells, though greatly decayed, and the parts having scarcely any coherence. Still, generally, even below, where these shells are most abundant, their quantity would not furnish as much as two per cent., and generally not one per cent., to the whole thickness of the bed; and therefore the carbonate of lime, though of course useful in proportion to its quantity, can give no appreciable addition of value to the mass as manure.

Here and there, but rarely, in the upper and dry part of this bed, crystals of gypsum are found, generally so small as to be barely distinguishable by the eye. In the lower and wet part, gypsum is never visible; but it is nevertheless believed to be always present in some proportion.

But the important and most characteristic mark of the green earth is present in the black granules called "green-sand," which give color to the mass. To ascertain the presence of these granules, let a small sample of the earth or marl supposed to contain them be dried, and then crumbled between the fingers, or, if too hard for that, by being rubbed in a mortar, not too finely and closely. Then take a pinch of the powder between the thumb and finger, and sprinkle it very thinly over a piece of white paper. If any of the separated grains appear black, (or green,) mash one of them with the moistened point of a pen-knife; and if it be "green-sand," the granule will mash like fine soapy clay, and make a vivid green smear.

For greater accuracy, let the earth (or marl) be well washed by agitation in water, and pour off the pure clay and other lighter matters which will remain longer suspended in the fluid. The grains of green-sand will then be left with nothing else but the quartz or silicious sand, and moreover the former will be made more perceptible, in consequence of being cleared by the washing of any previous covering of fine clay.

My first published account of this earth was made in or about the year 1828, in the old series of the 'American Farmer.' A much more extended article "On the Gypseous Earth of James River," I afterwards published, July, 1833, in the first volume of the Farmers' Register, beginning at page 207. Though up to that time I had never so much as heard of the term "green-sand," and though I adopted and used the new and unauthorized designation of "gypseous earth," the earth in question was described so minutely and accurately that it was impossible for any intelligent and attentive reader of the article, and subsequent observer of the kind of earth in question, to mistake the subject of description. I trust that I may be pardoned for thus specifying my claim to the first discovery of this earth in Virginia, inasmuch as that merit (if it be one) would be ascribed by every otherwise uninformed reader of the first report of the geological survey of Virginia, and some other of the publications from the same source, to the author of these pieces. Upon this occasion, it would be improper to say more on this question than thus concisely and explicitly to assert my just rights.

Before proceeding to offer the more precise and more valuable information concerning this earth obtained by very recent investigations, it will be proper to state something of the progress and changes of opinion on this subject, which operated at different times either to encourage or to obstruct the use of this earth as manure.

From 1818 to 1835 inclusive, I made numerous trials, and in some cases

extensive applications of the Coggins Point gypseous earth as manure. The results of my general practice, and also of many particular experiments noted at the times when made, were reported in a communication to the Farmers' Register, commencing at page 118, vol. ix. The effects stated were very different and apparently contradictory—sometimes beneficial and profitable in a remarkable degree, but more generally of little value, or of no benefit whatever. The inferences which I drew from all my experience, (and there existed scarcely any other facts or experiments,) were that this earth as manure acted in the same manner as gypsum, though more powerfully—and in no other manner than as gypsum would under like circumstances; that like gypsum, on my land certainly, and as I inferred in our tide-water region generally, this earth had no effect whatever (unless used in excessive quantity) on any acid soils—and rarely on any other crop than clover, even when properly applied on neutral or calcareous soils; and that when naturally acid soils were made calcareous by being marled, this green earth then became generally operative thereon as a manure for clover, (and for other plants of the clover or pea tribe,) in the same manner as is usual in regard to gypsum.* And though the effects, when any were produced, were greater than those of any usual or known dressings of gypsum, and sometimes in a very remarkable degree, still the failures and disappointments were so many that I did not deem the practice worth being continued. In 1841, my son, the present occupant of the Coggins Point farm, at my request, recommenced the applications of gypseous earth, for experiment; and on the clover of this year, 1842, he has extended the dressings over more than 60 acres.† The results were, as in former years, very unequal, and for the greater space of ground covered, unprofitable, and barely if at all perceptible. But on 25 to 30 acres the benefit was remarkably great, and in some cases (of summer dressings) improvement was obvious within ten days after the application. But what was most interesting in the results was, that a clue seemed to be thereby furnished to explain the frequent previous failures of this manure, even when applied to clover growing on neutral or calcareous soil, which are the only circumstances in which it has ever been found profitable in practice. My former applications had been generally made from the upper and greener stratum of the gypseous earth, (designated in a succeeding page as *C*,) or if from the lower and blacker part, (*D*,) the digging did not penetrate more than a foot, or, at most and rarely, two feet below the before exposed outer surface. But in the recent larger operation, the digging (made on the river beach) was so much more extensive as to furnish earth from depths of three or four feet, as well as of portions nearer to and at the surface. I ascribed the remarkable differences of effect to the kind and place of the earth; inferring that the exposed parts, and all perhaps near the surface, had, by exposure to air or water, lost a large proportion of the soluble or decomposable fertilizing ingredients. As the applications had not been made with any view to this question, the experiments are not to be deemed as conclusive, and the correctness of this inference is yet to be fairly tested by future experiments. But the benefits from some of the dressings, and all of those supposed to be from the deeper digging, were so great, and so speedily produced, that renewed and strong interest was

* See these views more fully set forth in the article above referred to, and also in another on the green-sand marls of Pamunkey, at pp. 679 and 690, vol. viii. Farmers' Register.

† See the facts and results stated in two communications to Farmers' Register pp. 86, 135 and 252, vol. x.

excited in regard to this manure. The quantity applied was generally 40 bushels of the earth to the acre. And this quantity seemed, (from an accurate comparative experiment) to produce as much benefit as 200 bushels. The growth of clover was increased in degrees varying from 100 to 300 per cent. And where the application was most successful, the increase and profit were sufficient to compensate the expense, even though no further benefit shall be found than in this one crop—or that a new application shall be required and be made for every succeeding crop of clover, or once in each round of the rotation of crops.

An observation made by accident last spring led to further chemical as well as other examinations of this earth, and to important results. Upon heating a lump of it to red heat, I found that strong fumes were thereby extricated, which were almost suffocating if inhaled incautiously. The odor was manifestly sulphureous in part, and principally; but it seemed not altogether so, but to be mixed with some other, much like that of muriatic acid gas. Similar trials were made on many specimens, and all the darker and (as supposed) richer layers of the green earth at Coggins Point showed the like result. From specimens of the upper and lighter green stratum (*C*) when heated red, there was nothing of this suffocating odor produced. And it may be useful to state here, in anticipation of subjects to be hereafter more fully considered, that I subsequently found that the New Jersey green-sand earths yielded not a particle of this gaseous product.

This odor, so far as it was sulphureous, was obviously the product of the decomposition (by red heat) of sulphuret of iron—which was thus proved to be universally diffused, though invisible, through all the darker and better kinds of this earth. Sulphur would have shown like results, with a much less degree of heat; but it could not be that, because the heat sufficient to decompose sulphur (and to evolve its fumes) had no effect on the earth. I also observed that lumps of the earth after having been applied as manure, and exposed on the surface of the ground for some months, often had a smell of sulphur; and, in some cases, the same effect was exhibited in specimens taken from the diggings, and kept dry. The sulphuret of iron, if universally present, would, by its decomposition in contact with carbonate of lime, (as when on calcareous land,) form sulphate of lime, (gypsum.) This showed a source for the universal supply of that manure to some extent. Further, Mr. M. Tuomey had found sulphate of lime ready formed in specimens of wet earth which I supposed the least likely to retain that ingredient—and thus was indicated another general supply of gypsum.

The increased interest excited by these new observations, and also the new views as to the cause of the failures of most of the former applications of this manure, induced the sinking of a pit in the gypseous earth, on the river beach at Coggins Point, to the depth of 18 feet below ordinary high tide. This digging for the lower 13 feet was in a very compact and fine clay (*E*) or clay marl, as it would have been designated in England, from its texture and sensible qualities, but which contained no visible or apparent fertilizing ingredient, except a very small sprinkling of shells, and elsewhere some little sulphuret of iron in small lumps and in minute crystals, visible in a few detached spots only. The appearances promised so little of value or remuneration, (and less so as the digging was sunk lower,) that the work was suspended. But the blacker earth above (*D*) and also the clay (*E*) were carried out for experiment on clover, (May 26th,) of which the first crop had just been grazed off closely, and the cattle removed. As the season was so far advanced, and benefit so little counted on, the covering was made heavier than in the winter and early spring before (and of which

the full benefit had been already seen on the first or spring crop of clover); 100 bushels of the upper and better earth, and 150 of the clay, being applied to the acre. A good rain fell the next night; and in less than ten days there were visible and manifest beneficial effects from both kinds of earth, but better from the upper—which effects increased to fully the doubling of the growth by the first of August. The hard lumps of the compact clay soon split and crumbled when exposed to the air, and even without rain. The remarkable benefits of these applications induced the resuming of the digging, and another and much deeper pit was dug as early as the other labors of the farm permitted, and a statement will presently be made of the section thereby exposed. But previous to this, it is proper to describe another like operation, and its results, at a more interesting locality.

The same general appearance of the gypseous earth, and mostly of the poorer kind of greenish color mottled with pale yellow clay, is exhibited all along the river bank of Coggins Point and the lands above, to the Evergreen farm—interrupted only by the parts of marshy or more ancient alluvial lands; or where the stratum has been broken and concealed by the ancient land-slips which have greatly altered the original levels and form of the surface of that whole stretch of land bordering on the river and overlying the green earth formation. This operation by the land slipping and sinking continues, and some new effects are seen every year. At many places along this stretch gypsum is perceptible in the green earth, either in crystals or in powder, and sometimes, and rarely, in considerable proportion, say from 5 to 15 per cent. of the whole mass. At the upper part of the river line of the Evergreen farm, (at the mouth of Bayley's creek, and two miles below City Point,) the river bank has peculiar and remarkable features, which deserve particular notice. It was here in 1817 that I first discovered this green earth formation, and thence traced it to my own farm and then residence, Coggins Point, and elsewhere in that neighborhood.

The lower visible part of the body of green-sand earth at Evergreen is laid bare by the wasting inroads of the river, (by which it is rapidly washing away,) for 200 yards in length. The southern or upper extremity, for some 20 yards, approaches nearly in appearance to the general character of the upper stratum before described. But all the remainder is different, and much richer in the dark or green granules than generally elsewhere.

Since this article was commenced, Capt. H. H. Cocke, the present proprietor of Evergreen, at my suggestion and request, had a shaft dug for examination, which, with an extension of my own after he had ceased his operations, added to the natural and higher exposure of the section, 27 feet below the beach, and 25 below common high tide. The several strata of the whole section, and their variations, will be described in their descending order.

At top—

1st. Surface soil (sloping back irregularly to the table land, which is much higher,) on (2d) gravelly and sandy sub-soil, pervious to water, of various depths—lying on strata nearly all horizontal. Next,

10 feet of yellow sandy miocene marl.

8 feet of yellowish clay, (supposed eocene,) intermixed throughout with very small crystals and powder of sulphate of lime—the clay not compact or solid, but open and loose throughout. (Query: Is not this the equivalent of the eocene marl at Coggins Point, with its former shells and carbonate of lime completely changed to sulphate of lime, and the remainder dissolved and lost?)

5 feet of gypseous earth—the general color, green mottled and streaked with yellow ochre, and full throughout of very minute crystals of sulphate

of lime, supposed to be about 10 to 15 per cent. of the whole mass. No shells or casts seen in the part exposed by digging for examination.

7 feet of brownish mottled clay, feeling smooth and soapy, containing numerous small crystals of sulphate of lime.

9 feet very pure white clay or fuller's-earth, in horizontal layers, separated by veins of the yellow clay (or iron ochre) before mentioned, other veins of the same sometimes also inclined and crossing the horizontal veins—the outsides of the lumps of clay colored by oxide of iron. The clay all broken into irregular lumps, as if the fissures had been formed by the contraction in drying of clay soft and distended with wetness. No shells, nor appearance of them, but many pure and transparent and beautiful crystals of sulphate of lime here and there, some weighing several ounces. This stratum changing gradually into the next of

4 feet of dark bluish clay, the coloring matter being green-sand, mottled with irregular streaks of bright yellow, becoming brown below where oozing water begins to show and is reddish with sulphate of iron, or other ferruginous matter in solution. This stratum full of large and solid crystals of sulphate of lime, amounting apparently to from 25 to 35 per cent. of the whole mass—the crystals colored dark gray, because of some impurities in small grains (green-sand?) being enclosed and diffused through them. No shells. This changing into the next, of

11 feet of same dark or nearly black clay, nearly uniform color, and still compact texture, and feeling smooth and soapy—with very few crystals, and much less sulphate of lime than the preceding, but many small and scattered eocene white shells, quite rotten, and, being moist, as soft as dough. The shells, mostly several kinds of very large turritellas. Fewer shells as descending. At top of the stratum some large and very perfect specimens of the *ostrea compressirostra*.(?) To level of the river at common high tide.

Below high tide.

14 feet very similar to the last, the shells very few for the greater part, but increasing near the next. No crystals or other sulphate of lime visible. The green-sand granules coarser—sometimes in small lumps quite pure, or unmixed with any thing else. These granules breaking easily, though as if hard or brittle, and not like a soft soapy clay as usual—though as green as before. Many small cylindrical tubes seen, which seem to be formed on, or coated with pure green-sand in mass and green in color, and the hollows filled with black granules.

11 feet of shells lying generally close together, and serving to make the whole stratum a calcareous marl, of perhaps 30 per cent. or more of carbonate of lime—the earth filling the shells and between them being the same black earth, as rich as before in green-sand. At top, some very large and perfect shells of *ostrea compressirostra*, and another much thicker *ostrea*, not known.* The shells mostly very large *turritellæ* of different species—near bottom fewer of these and mostly *crassatellæ*. The shells nearly as numerous as before, at this depth, at which the digging was abandoned, at 25 feet below tide.

The whole section, from the top of the highest undoubted eocene stratum to where the digging ceased, (without any indication of being near the end,) is 61 feet—and if the clay and gypsum stratum below the

* One of these last (both valves) weighed 5 lbs. Mr. M. Tuomey, to whose much better information on this subject I ought to defer, supposes this very large and heavy shell to be an *O. compressirostra* of unusual age and growth. If so, however, it is certainly very different in appearance from that shell, as usually seen higher up in this bed, even when wider than the very thick and heavy ostrea.

miocene be added, which, though not certain, I believe to be eocene, there would be 69 feet. And if this and the two other lower clay strata be deducted, there will still remain 45 feet of strata exposed, all rich in green-sand, and of it 9 feet very rich also in suiphate of lime or gypsum, and 11 feet moderately rich in carbonate of lime. Such a deposite is well worth the examination of geologists and chemists, and the trial of farmers.

It was remarkable that at this place only of all the usual strata of all the then known deposites of green-sand or eocene marl in Virginia, were found exposed, the shells of the *ostrea compressirostra*—and below tide the other before unknown and very thick and heavy ostrea; and that at this place there has not been found a single shell of either the *ostrea sellæformis* or *cardita planicosta*, the latter of which is so abundant through all other known eocene deposites, and the former in the calcareous eocene elsewhere. These facts seemed to indicate (as well as the general dip to the eastward,) that the strata at Evergreen are much more elevated than the same at Coggins Point—and that by digging deeper, the lower and all the strata of the former might be found at other parts of the known area (before described) of the eocene formation.

This inference added to other considerations caused to be sunk the second shaft above mentioned in the beach of Coggins Point, 130 yards distant from the first one, which by this time had been filled completely by the sand driven by storms and high tides. The digging was made at a low part of the bank, and which therefore did not show either the eocene marl or the miocene, the former of which is seen in the higher bank at a short distance, and both together at the distance of a mile. The different strata of the actual section at the new digging, taken descending from the top of the bank, were as follows:

1 foot, surface soil—gray loam, ancient alluvial deposite.

7 feet of pale yellow clay, containing much coarse silicious sand.

4 feet rounded or water-worn pebbles, of all sizes, from 4 inches through to coarse gravel, held together by enough clay and ferruginous earth to fill the interstices between the pebbles. None calcareous.

2 feet of very thin layers of hard and gritty gray clay, alternating with others of coarse ferruginous sand.

2 feet of poor greenish earth, more than half the surface of the section brown in spots, and indurated with oxide of iron.

(Here should be, as elsewhere in the neighborhood, though absent at this particular locality, either one or both, the miocene marl, (*A*,) and next below the eocene calcareous marl (*B*) described in the preceding pages.)

(*C*) 9 feet of the ordinary upper layer of gypseous earth—green color, mottled with spots of bright yellow clay, (or ochre,) and some other spots of unctuous reddish brown clay. Very slight efflorescence of gypsum on the surface.

(*D*) 3 feet of darker and nearly uniform color, almost black, from the greater proportion of green-sand. This and the preceding, containing many impressions of shells, but no shells or fragments, and no carbonate of lime. More efflorescence of gypsum, and also on next—

(*D*) 3 feet of same, except that some shells are seen—and increase in the next to level of river at common high tide.

(*D*) 6 feet of same (next below tide—) the shells mostly *cardita planicosta* —fewer of *cytherea* and *corbula*. No *ostrea* or *turritella*. Small and slender shark's teeth (so called) in perfect preservation. the points and edges being as sharp as in teeth of the living animal.

(*E*) 15 feet bluish gray or lead-colored clay, (from 6 to 22 feet below tide,)

having nearly the texture of clay marl. Very compact and firm in texture—unctuous to the touch, but not adhesive or tough—does not bend to pressure, but breaks—cuts smooth, except when the edge of the knife meets parts of shells, or grains of silicious sand, which, as well as granules of green-sand, are irregularly intermixed throughout. The shells very rotten, and flattened by pressure. Sometimes in masses, or thin bands or regular layers, becoming less and less in quantity as descending, and but few seen at and below 10 feet of this stratum. Numerous particles of mica throughout. Changing gradually to next. At 12 to 13 feet of its depth, many hard lumps of sulphuret of iron. The upper three or four feet of this penetrated by numerous hollow cylinders, of an inch or more in diameter, and in every direction—obviously having been bored by shell-fish. These hollows are filled by the green earth of the stratum above, which thus makes nearly half the mass. (This clay and the layer above (*D*) were the kinds used for manure from the first opened pit.)

3 feet (22 to 25 below tide) of brownish and more friable clay, intermixing at first with the above. Green-sand much more abundant than in the preceding, and partly in very large granules.

3½ feet (25 to 28 below tide) of very smooth and firm clay, of delicate lilac color at first, but becoming paler as descending, until nearly white. Splits easily into flakes like thick slate; and still thinner laminæ show that the earth was a deposite in tranquil waters. Thin flakes (not thicker than writing paper,) and sometimes a mere powder of pure sulphuret of iron visible between many of the layers of clay, and causing them to separate easily. The upper foot of this every where penetrated by small hollow tubes, (from an eighth to the third of an inch in diameter,) which are filled by the brown and green variegated earth of the stratum above—causing a lump when cut smooth to appear like a conglomerate of differently colored marbles. Except in these borings, no green-sand deposite, and no shelly matter. The sulphuret of iron, which is through this stratum visible in powder, or thin layers, and above in small masses or lumps, is diffused through all the strata containing green sand, except the highest (*C.*) Through this and the upper gray clay (*E*) some small black pebbles seen, which appear as if formed by melting. The same found in the eocene marl. A sudden change to the next—

2½ feet (28½ to 31 below high tide) of remarkably smooth and unctuous, but firm clay of reddish brown color, (or dull brick red,) and homogeneous texture as well as color. Cuts as smooth as the best hard soap. Deposited in thin laminæ, and breaks or splits easily in straight lines both in the direction of the laminæ and lengthwise at right-angles to their direction—the grain and fracture appearing like that of rotten wood. Across these two directions, the fracture very uneven. Near the bottom of the richest green stratum (*D*) there is a barely perceptible oozing of water. All below dry, and the two last strata remarkably dry. They could not be more so if within three feet of the surface of a high knoll.

1 foot (31 to 32 below tide) of same as the last in texture, but of pale blue color.

1 foot (32 to 33 below tide) mixture of the last, in small lumps imbedded in the next, as if broken up by a violent current, and deposited in rapid water.

17 feet (33 to 49 below tide, the lowest digging,) black earth—richest in green sand (supposed to be 60 per cent) mixed with a few fragments (less than 2 per cent. on an average) of shells—mostly small, and all very rotten. Kinds, mostly of *turritella* (some of which are large,) *mytylus*, *corbula* and *crassatella*. Many small and a few large shells of *ostrea compressirostra* near top of this stratum and again near the lowest part, where the work was stopped by the water rising from below.

The whole, so far as dug, added to the before exposed bank, amounted to 66 feet of the eocene deposite, of which 49 feet was below the level of high tide. The last stratum, of which was penetrated 17 feet before the rise of spring water compelled the work to be discontinued, was manifestly the same with that at Evergreen which was even with high tide (and extending above and below,) and which was there 25 feet thick. It was a subject of much regret, after so much labor, that the still lower stratum, full of shells, could not be reached, and which probably might have been done in 8 feet more of digging. However, enough was done to show that the quantity is inexhaustible of the layers richest in green-sand, (whatever may be that degree of richness,) independent of the other layers.

Besides the main object of this laborious examination by digging as low as possible, to learn more of the quality and quantity of the earth for manure, and as a matter of curiosity, there was another inducement. The whole bottom of the river across to Berkley (below the thin covering of loose and soft mud,) according to its variation of depth, must be formed of one or another of the same layers shown in this digging of 49 feet below the water level; and, of course, Harrison's Bar, which lies between the Coggins and Berkley shores, must be so formed. No earth more strongly resists the washing action of water than the gypseous earth, even when the least mixed with clay. This peculiar quality must be the cause of the existence of this bar, which presents so serious an obstacle to the navigation of the river; and it may be thence inferred what would be the degree of difficulty of its removal, and also that the removal if effected would be permanent.

Various and contradictory as had been many of the results of my experiments of the green earth as manure, there had been perfect agreement in some respects. Thus, as before stated generally, the earth has never been beneficial as manure on acid soil—but rarely on corn, and never (directly) on any other grain crops; and (on proper soils) generally and greatly beneficial on clover, and perhaps all plants of the clover and pea tribe—and the effects, when produced, have never been permanent, nor even very durable. And the effects shown in these points of agreement were nearly all the reverse of those ascribed to the New Jersey green-sand. In regard to these effects, in the absence of all certain and particular information to be obtained otherwise, I found it necessary to seek information in person. The results of my inquiries and personal examinations, in general, showed that the green-sand (called marl) of New Jersey, though agreeing in some respects with ours in action as manure, is operative generally on the greater number of soils and on most crops, and is also very durable in effect. On the other hand, much larger quantities are applied there, (usually 200 bushels, and sometimes 400 or more to the acre) than I have done with ours; and something of the more general benefit, and longer duration may perhaps be owing to that circumstance.* Whether the green-sand is indeed the principal, or a very important manuring agent, of the James river earth, or whether the other ingredients may not be still more active than its green-sand, is yet undecided.

It is indeed strange that such doubts should exist at this late day as to the manuring action and effect of this earth—and still more so that the chemical composition and ingredients of the earth should not have been long ago ascertained. Yet previous to the recent imperfect application of tests above referred to, there had been no known full or correct chemical analysis made of the earth in question; nor even any partial examination for and report of the ingredients, that was entitled to any respect for

* See report at length on the New Jersey green-sand, and its operation, at page 418 vol. x. Farmers' Register.

accuracy and fidelity. For these reasons, I engaged the valuable services of Professor C. U. Shepard, for the analyses of specimens which I selected from the different strata of the earth at Coggins Point, exposed in recent diggings, including several which had been tried as manure and had operated with remarkable power and benefit. His report of the analyses, which has been received since the preceding and subsequent portions of this article were written, will now be presented. It enables me to furnish more of what is valuable, because more certain than every thing else I could offer, or than has before been offered to the public on this subject—prominent as it has been made in the reports of the geological survey of Virginia.

New Haven, October 26, 1842.

Dear sir—The specimens of green-sand and accompanying earths have, agreeably to your request, received my particular attention; and I now proceed to apprise you of the results at which I have arrived.

Commencing with the mechanical analysis of the green-sand, I was not a little surprised to find that the green particles, when cleared by washing of a slight investment of clay, assumed the aspect of chlorite and green earth, and more rarely of grains of serpentine and fine scales of mica. The other ingredients of the earth were chiefly grains of quartz, (some of which were penetrated by chlorite,) and more rarely specks of garnet, iron pyrites, and what appeared to be yellow phosphate of lime. Fragments of shells, in a very decayed state, occur disseminated through the earth; and I detected also small teeth and bones of fishes. The proportions of the leading ingredients are very difficult to establish with precision; and after all my examinations I can only give them approximatively and within wide limits. Thus, the quartz grains may be said to constitute from 60 to 80 per cent., the chloritic and micaceous grains from 10 to 15 per cent., and the fine clay from 3 to 5 per cent.

Nothing is plainer than that the green particles possess the character here attributed to them; since they put on all the properties so common to chlorite, being sometimes in regular hexagonal plates, though usually in little granules made up of impalpable grains, which under the pestle easily separate, with an oily feel, into bright green specks. Subjected to acids and heat, it agrees with true chlorite.

The existence of such a mineral in the present formation offers nothing remarkable in a geological point of view, since it may have originated in the decomposition of chlorite slate rocks, or of veins in primitive rocks, (in which chlorite often abounds,) and in both cases iron pyrites is its common attendant. Besides, it may have been derived from the metamorphosis of pyroxene, or from amygdaloidal traps, a source of green earth very often recognized in Europe and America. Indeed, chlorite (which is but another name for green talc) is often interchanged for mica as an ingredient of primitive rocks, and is every where little prone to decomposition, being, on the whole, one of the most persistent of the simple minerals.

Neither can it be objected that its chemical constitution is incompatible with the results obtained for green earth; for here we must bear in mind, also, that it is impossible accurately to separate the green particles from the mica, serpentine and other ingredients with which they are associated.

M. Berthier found the following composition in the green grains from the green sand of Havre (France)—

Silica	50.00	
Protoxide of iron	21.00	
Alumina	7.00	
Potassa	10.00	
Alumina	11.00	
		99.00*

Mr. Seybert found in that of New Jersey—

Silica	49.83	
Alumina	6.00	
Magnesia	1.83	
Potassa	10.12	
Water	9.80	
Protoxide of iron	21.53	
Loss	89	
		100.00†

* Geological Manual, by H. T. de la Beche, Phila., 1832, p. 255.

† American Journal of Science, vol. xvii., p. 277.

Prof. Wm. B. Rogers found in the green-sand of Virginia—

Silica	51.70
Protoxide of iron	25.20
Potassa	10.33
Water	10.
Magnesia, a trace.	
	97.23*

The foregoing may be taken as a fair exhibition of the composition of the green particles in green-sand; and the following analyses may serve to show the constitution of such chlorites and mica as may be presumed to be most analogous to the green substances in the earth under consideration.

M. Vauquelin found in the green-earth of Verona—

Silica	52.00
Magnesia	6.00
Alumina	7.00
Protoxide of iron	23.00
Potassa	7.50
Water	4.00
	99.50†

Dr. Thomson found in the chlorite-earth, from the highlands of Scotland—

Silica	43.166
Magnesia	2.916
Alumina	16.851
Oxide of iron	19.309
Potassa	6.558
Lime	2.675
Water	2.350
	98.718‡

The composition of the most common silvery mica from Zinwald (Bohemia) was ascertained by M. Klaproth to be the following—

Silica	47.
Alumina	20.
Potassa	14.50
Ox. iron	15.50
Ox. manganese	1.75
	98.75§

Having described the grounds on which I arrive at the conclusion that the green grains of this earth are chlorite, or chlorite blended with mica, and rarely specks of serpentine, I cannot but express the opinion, that as a nutritive manure the efficacy of the green particles has been greatly overrated. As these particles are very little liable to decomposition, their action, whatever it may be, must be slow, and, I should infer, nearly imperceptible. Indeed, I am rather disposed to regard its favorable operation, if indeed it has any, as flowing from a mechanical agency, after the manner of a clay, than as arising from the liberation of its potassa through chemical decomposition. Not that I would call in question the usefulness of the earth taken as a whole, for happily this is too well established. But when I find a decided content of sulphate of lime, with carbonate and phosphate of lime in addition thereto, together with distinct traces of organic matter, it appears to me unnecessary to look any farther in order to account for the phenomena in the case.

I now proceed to state my method of examination, together with the results obtained.

The specimens were kept in a dry room, exposed to air in shallow dishes, for several weeks; after which, portions free from crystals of sulphate of lime visible by the naked eye, and large fragments of shells, were heated in a platina-capsule to 300°, Fah., in order to expel hygrometric moisture, and subsequently to low redness, to decompose organic matter.‖ The organic matter is very inconsiderable, and was in no instances rigidly determined.

Having ascertained by experiment that the iron-pyrites was not decomposable by tepid dilute hydrochloric acid, the following method was resorted to for the determination of

* Farmers' Register, vol. ii., p. 131.
† Shepard's Mineralogy, vol. ii., p. 225.
‡ Idem. ii., p. 225.
§ Idem. ii., p. 41.
‖ This last step was always attended with the extrication of a little sulphur.

the phosphate of lime. Two hundred grains of the triturated earth were suffered to stand (with occasional agitation) in contact with a dilute hydrochloric acid for three hours. The whole was then transferred to a filter, and the earth well washed thereon, with abundance of tepid water. The clear fluid and washings thus obtained were super-saturated with ammonia, and the precipitate subsequently digested in a warm potassic solution for the removal of the silica and the alumina. The per-oxide of iron and phosphate of lime now remaining, after being well washed, were treated with a cold, dilute acetic acid, whereby the phosphate alone was taken into solution. It was then precipitated by ammonia, dried, ignited and weighed. Having found reason to believe that the proportion of finely divided phosphate of lime was pretty uniform in the different specimens of the green-sand, I was only at the pains to determine its exact proportion in specimen No. 1.* Having ascertained how much peroxide of iron each sample contained, this amount was deducted from that yielded by the treatment of the same specimen with nitro-hydrochloric acid, (aided by gentle heat,) whereby the sulphuret of iron was decomposed. Thus the exact quantity of iron which was engaged by the sulphur (and consequently the amount of bi-sulphuret of iron) was ascertained.

The carbonate of lime was determined in the usual way, viz., by treating the first obtained solution in hydrochloric acid with ammonia, whereby the silica, alumina, peroxide of iron, and phosphate of lime were thrown down, leaving the lime and magnesia alone in a state of suspension. The former was precipitated by oxalate of ammonia, and subsequently the latter by phosphoric acid.

The sulphate of lime was ascertained by boiling a determinate quantity of the green-sand in water until the whole of this salt present was taken into solution. The clear solution was treated with chloride of barium, and the sulphate of baryta ignited and weighed. The sulphuric acid present in the earth was thus arrived at, and, by subsequent calculation, the sulphate of lime originally present was ascertained.

Sulphate of alumina (but no sulphate of iron) was found to exist, in traces, by the precipitation of alumina, occasioned on the treatment of the water boiled on the earth with ammonia. But in each case it was too inconsiderable for the determination of its proportion. Chloride of calcium (muriate of lime) was ascertained by treating the same fluid with nitrate of silver. Its proportion did not exceed that in which it exists also in common soils.

Results obtained on specimens of green-sand earth from Coggins Point, James river.

"No. 1. From 8 inches within the exposed side of a ravine, where a stream flowed by, and 15 feet from the top of the green earth."† [Middle part of stratum *D*, see page 218.]

Hygrometric moisture, (lost at 300°) - -	5.50
By heating to low redness, it lost in addition	2.03
Phosphate of lime - - - - - -	0.25
Carbonate of magnesia, in decided traces.	
Sulphate of alumina, in traces.	

"No. 3. Same as number 1, except from a deeper excavation.

Hygrometric moisture (lost at 300°) - -	4.600
By heating to low redness it lost in addition -	2.200
Carbonate of lime - - - - - -	1.550
Bi-sulphuret of iron - - - - - -	3.066
Carbonate of magnesia and sulphate of alumina in traces.	
Phosphate of lime, about as in number 1.	
Sulphate of lime - - - - - - -	0.813

"No. 6. Three feet below the river beach, [from pit, lower part of *D*, half a mile distant from preceding.]"

Hygrometric moisture - - - - - -	5.400
By heating to low redness, it lost in addition -	2.000
Carbonate of lime - - - - - -	0.535
Bi-sulphuret of iron - - - - - -	2.060
Sulphate of lime - - - - - -	0.661
Carbonate of magnesia and sulphate of alumina in traces.	
Phosphate of lime as in number 1.	

* I will here observe that, by the process now described, it was ascertained that had the whole of the precipitate by ammonia from the hydrochloric acid solution been taken for phosphate of lime, it would have involved the error of an over estimate of the phosphate by nearly 800 per cent.

† This specimen was not thoroughly analyzed, and therefore the contents are reported but in part. The next (No. 3) was deemed the most important, and a more correct specimen of this layer, (D,) and therefore to it the examination of Prof. Shepard was especially

"No. 9. See foregoing, page 218. Having sulphuret of iron in powder, or minute crystals;" [taken from 14 feet below the beach, in *E*.]

Carbonate of lime	2.350
Bi-sulphuret of iron	5.821
Sulphate of lime	2.309

(Carbonate of magnesia not found.)

"No. 10. Several thin layers of compressed shells. 1 to 3 inches thick," [contained in stratum *E*.]

Carbonate of lime	56.00
Phosphate of lime	0.84

No. 2. [*D*] from 4 feet lower than number 1, was examined with results similar to 1 and 3.

No. 4. [*D*] from 4 feet below beach, and half a mile from number 1, was found to be rich in sulphate of lime and to contain bi-sulphuret of iron.

No. 5. [*D*] "From another spot, and has been exposed to the weather from last winter to June on the field where applied as manure." Is richer than No. 2 or 4 in sulphate of lime, but inferior to either in bi-sulphuret of iron. It likewise affords more sulphate of alumina than any sample examined.

"No. 11. The clay at 16 to 18 feet deep;" [supposed when selected to be the poorest part of stratum *E*.]

Carbonate of lime	1.45

It is rich in sulphate of lime, and has traces of sulphate of alumina, and bi-sulphuret of iron.

It is to be kept in mind that in these analyses no account is taken of such sized crystals of sulphate of lime as readily meet the eye, or of large fragments of shells, the occasional presence of both which must often essentially enhance the gypseous and calcareous contents of these samples. The proportions in which they may occur at different depths and localities can readily be determined, however, by the practical agriculturist. The same may be said of the phosphatic ingredient so far as the teeth and bones of fishes are concerned.

If we assume the average proportion of bi-sulphuret of iron in these earths to be 2 per cent., and suppose the whole of the sulphate to become oxidized, it would give rise to 2.722 per cent. of sulphuric acid; to saturate which would require 1.905 of lime, and thereby produce 4.627 per cent. of (anhydrous) sulphate of lime. But 2.722 of lime would demand 3.383 per cent. of carbonate of lime in the soil. Now in the three analyses (Nos. 3, 6 and 9) made, the bi-sulphuret of iron, by average, equals 3.649 per cent., and the carbonate of lime in the same equals but 1.478 per cent.—a quantity too small for the saturation of the acid, even after a liberal allowance is made for the increase of calcareous matter from the occasional presence of large fragments of shells.

It would therefore appear to be an obvious deduction from these inquiries, that dressings of lime, and especially of calcareous bands, like No. 10, should be employed in conjunction with the green-sand soil.

Having now replied in the best way I am able to your various inquiries, I leave it for you to make such other practical inferences from the information afforded as in your more experienced judgment it may seem to authorize—and remain, very respectfully, your obedient servant, CHARLES UPHAM SHEPARD.

EDMUND RUFFIN, ESQ., Petersburg, Va.

The specimens numbered above 1, 2, 3, were from one locality, and of earth which was used as manure for clover of this year, with effect as great as any ever known on marled land; and with no certain benefit on an adjoining space, (also in clover,) of the same soil naturally, but not marled. Numbers 4, 5, and 6, were from the pit dug in the beach, half a mile distant, apparently similar to each other, and to the preceding specimens. All these are of the dark stratum (*D*) richest in green-sand, (except the lowest, *E*,) and all before rated by me as containing 50 per cent. of the pure granules. Professor Rogers stated the same to contain 60 to 70 per cent. (See F. Register, vol. ii., p. 750, and 2d edition of 'Essay on Calcareous Manures,' p. 116.) Even if leaving the green-sand out of consideration, and out of the estimate of value, there would still remain enough of active manuring principles to produce a large share of all the beneficial effects which I have found from the use of this earth; and I have

requested, and was so directed. It is therefore that the contents of bi-sulphuret of iron, carbonate of lime, and sulphate of lime are not stated of No. 1, as in No. 3.—E. R.

heard of but few other applications in Virginia, other than those made on Coggins Point farm, and of none with different or better *certain* effects. With the help of surplus carbonate of lime in the soil, (furnished by nature or by previous marling or liming,) 100 bushels of this earth, averaging in strength the ingredients of these specimens analyzed by Professor Shepard, would furnish nearly 5 bushels of pure sulphate of lime (gypsum); and 40 bushels to the acre would furnish 2 bushels of sulphate of lime. Not one of these specimens contained any gypsum visible to the eye; and but one specimen (number 9) contained any visible sulphuret of iron; and therefore these ingredients may be fairly supposed to be at least as abundant in the earth dug in any considerable operation. What the green-sand or any other ingredients may do in addition, I pretend not to estimate. But so far as I have learned from my own experience and all known experience of other persons, the whole operation of this earth, when used alone, is precisely of such kind as I would anticipate from gypsum, though yielding more of benefit in measure and value. Nor should I therefore be understood as placing a low estimate on the value of the effects produced. Since seeing the effects this year, and especially since having formed the opinion that the upper and exposed parts (most generally used formerly) are comparatively worthless and should be avoided, I count on much benefit being derived from this manure, and am desirous that it shall be largely used; as my son and partner, and the sole director of our farming, proposes to do for the next year's growth of clover. Still, I am now as far as ever from believing in or expecting such great and regular benefit as would be inferred to be certain from views and statements which rest upon other authority.

It may not be useless to note another point of recent resemblance between these two manures, both of which seem so capricious and uncertain in operation in general. This year (1842) the applications of the green earth on the Coggins Point farm, whether made in the beginning of the winter preceding, in March, or in the beginning of summer, have acted more quickly and powerfully than any known before. This I had ascribed to the earth being mostly obtained from deeper excavations. But I have lately heard, from Messrs. Hill Carter and John A. Selden, both extensive and experienced and successful users of gypsum, that they have never before known the good effects of that manure to be so remarkable as in all their applications of this year.

(*d.*) EOCENE GREEN-SAND MARL.

Except in the lower stratum exposed in the pit recently dug at Evergreen, this peculiar valuable kind of marl has not yet been known in Virginia elsewhere than on and near the borders of the Pamunkey river; though there can be but little doubt that this or other eocene deposites are to be found elsewhere than within the limits here stated of the now known localities. It is more than probable that other rivers cut through and expose some of the eocene as well as miocene deposites; and that deep diggings would reach them also in the intervening high lands. The Pamunkey eocene marl is seen first, or most eastward, at Liberty Hall, (Mr. Waring's farm,) in King William county; and it is found on nearly every farm above, to South Wales, in Hanover, the farm of Mr. William F. Wickham, just below the junction of the North Anna and South Anna rivers, and on the farm of Mr. Williams Carter, across the Pamunkey, in Caroline county. This distance in a straight line is about 28 miles; and the very winding course of the Pamunkey serves to make the exposure

of the bed of marl show an average width of three or more miles. Throughout this area, it is found in great abundance at numerous points—though of great variety of appearance and of value at different elevations, and in very different degrees of accessibleness, or ease of working.

This marl every where has its calcareous portion (which is usually small in comparison to good miocene marls,) intermixed with a large proportion of green-sand. The calcareous earth varies from 10 to 40 per cent. at different diggings, or different layers at the same locality; and the green-sand perhaps from 20 to 40 per cent. as estimated by the eye.* In some places, the one ingredient predominates in quantity, and elsewhere the other. No one specimen has been found rich in both of these ingredients. So far as known, the remainder of the whole mass, (as in miocene marls,) is of silicious sand and clay.

Below this green-sand marl lies a bed of brownish green earth, slightly sprinkled with small eocene shells and their fragments, but which, or all the calcareous matter present, would very rarely amount to 5 per cent., and sometimes not 2 per cent. To this lower stratum is also applied the term *marl* by the proprietors, as is done in New Jersey. But this term should not be given where the calcareous earth is so small in amount as 5 per cent. Though it may be impossible to draw a precise line of demarkation, either on the banks, or to distinguish them by definition in words, still these two earths ought to be known by different terms. By *green-sand earth* or green earth, will be here understood the lower stratum, or any other having green-sand in considerable quantity, and not more than 5 per cent. of calcareous earth, if any. And I would not consider any as *green-sand marl*, that did not have as much as 10 per cent. of carbonate of lime—leaving as doubtful and debatable, such as had more than 5 and less than 10 per cent.

The Pamunkey river is very narrow and yet deep, and its high banks, or cliffs, formed generally of green-sand marl and green-sand earth, are nearly perpendicular. The remarkable power which green-sand has of resisting the washing of water, is doubtless the cause of the narrowness of this river, and of the forces of its strong ordinary tides and violent current in freshes having operated to deepen the channel, instead of wearing away the banks. Slides of the banks, or land-slips, are frequent; large masses of the upper stratum of soil breaking loose, and, with the growth of large trees, slip down the steep bank into the river, scraping clean the exposed parts of the strata in the descent. In this way, sections of the bank 40 feet or more in height are exposed more completely to view than would be done by the progress of any diggings for marl, however rapid or extensive.

The general appearance of any one of such sections, taken at one of the several exposures from one to five miles below Newcastle ferry, is as follows: At top, below the soil and ordinary sub-soil, (or diluvial earth,) of say 10 to 20 feet, there is generally, though not always, a stratum of some 4 or 5 feet of *olive colored earth*, so called, and which term is descriptive of the appearance. This earth is of a greenish brown color, contains small sharks' teeth and fishes' bones, but no shells. Its appearance so nearly resembles the marl below, that it has been sometimes dug and used instead, either from the ignorance of the conductor or the carelessness of the laborers. It is entirely worthless as manure, as has been proved by careful experiments. A well dug (to obtain water) at Piping Tree ferry, penetrated very deep into this olive earth without reaching marl. The earth thus removed was used as manure, without any benefit being produced.

* These and all others named *supposed* proportions of green-sand were written before receiving Professor Shepard's report. His analyses make it seem probable that all my guesses of such proportions were too high.

Mr. Conrade Webb informed me that on his estate in New Kent he had made very careful comparative trials of applications of this olive earth, on land with and without marling, opposite to like pieces without the olive earth; and in neither case did its application show any effect.

Next, under this olive earth, is green-sand marl; sometimes the upper part has layers full of the saddle oyster shells, in place, which also occur scattered throughout all this marl. Sometimes, as above Newcastle ferry, there are interspersed hard lumps much richer in calcareous matter than the surrounding body. The matrix in which these accidental bodies are imbedded, or the whole body when they are absent, is a dark gray marl, of nearly homogeneous texture, containing green-sand in large proportion, and very few shells or fragments. This sometimes continues down to the green-sand earth. But at and a little above the ferry, (on Mr. Carter Braxton's farm,) there occurs between them a stratum of larger shells, mostly the *cardita planicosta*, as close together as they can lie, well preserved in form, though very rotten, as all the white shells are. The shells of this layer are often stained superficially of a deep and vivid green, by the green-sand. This layer of shells lies on the brownish green earth before mentioned, having very little calcareous matter, and of which the depth is unknown, as its bottom has never been reached in any of the diggings. This layer of whole shells was not seen elsewhere.

Such is the succession of strata at the fine bank of Mr. Carter Braxton, Hanover, a little above Newcastle ferry; and specimens of the several kinds, analyzed carefully, afforded the following results of calcareous matter. The proportions of green-sand were merely guessed at by the eye, but by careful examination, and with the aid of a magnifying glass.

Upper stratum furnishing the greater proportion of all used for manure:
100 grains contained of carbonate of lime - - - - 37 grains.
100 grains of lower stratum only - - - - - - 2
Another specimen of upper stratum, carbonate of lime - - 10
and green-sand moderately coarse (supposed,) - - - 40
At the ferry:
100 grains of upper stratum, carbonate of lime, - - - 15
and (supposed) of green-sand - - - - - - 35
Lower stratum of same, carbonate of lime - - - - 6
Masses of stony hardness, interspersed in same, contained of
carbonate of lime - - - - - - - - - 67
and green-sand - - - - - - - - - 3

At Mr. J. W. Tomlin's land, Hanover, about a mile below the ferry, the visible section of marl and green-sand earth together is 32 feet high, above low tide mark, and the green-sand earth making only 7 or 8 feet of the lowest part. All is eocene—as I found saddle oyster shells at the top of the light colored upper layer, next to the diluvial sandy sub-soil.* Specimens taken from different heights on this bank yielded the following proportions of carbonate of lime:

From 7 feet above low tide, 100 grains contained of carbonate
of lime - - - - - - - - - - - 35
At 14 feet - - - - - - - - - - 31
At 29 feet - - - - - - - - - - 15
Upper light-colored stratum—(not including in the specimen
any of its few large saddle oyster shells) - - - - 6
Thin stratum of hard shelly marl, low in the section - - 45

* This light colored upper layer is stated by the state geologist, in his report, to be miocene. See first report, of 1835, and same copied at p. 670, vol. iii., Farmers' Register.

The green-sand stratum (brownish color) of 7 or 8 feet above the water was not analyzed; but, as at all other places on this river, was evidently very poor in calcareous matter.

On the land of Mr. George W. Bassett, Hanover, about 5 miles below Newcastle ferry, the marl appears rich and of more homogeneous texture and uniform appearance than generally elsewhere. Yet it is variable, and on the average is poor in calcareous matter. However, this marl, which has been largely used by Dr. Corbin Braxton, water-borne to Chericoke, 8 miles below, has been wonderfully efficacious. Still it has not been used at all, or considered worth being applied, by its proprietor. Specimens analyzed at different times showed the following proportions of calcareous matter:

Stratum a few feet above the level of river, 100 grains contained of carbonate of lime,	10 grains.
And green-sand (supposed,)	35
Another (furnished and analyzed in 1840) carbonate of lime,	11
And green-sand,	27
Another, from different part of same bank, carbonate of lime,	45.50

This body was examined personally by the state geologist, and his estimate of its contents of carbonate of lime and of green-sand was 34 per cent. of each.

Over this marl is a regular stratum, perhaps 5 feet thick, of the olive earth. The marl descends to the level of the river, and therefore the green-sand earth below is not here visible.

In the river bank of Northbury, in New Kent, one of the farms of Mr. Conrade Webb, the green-sand marl presents the usual appearance, and is overlaid by the olive colored earth. To my eye this marl was rather poor in the calcareous ingredient, and, as Mr. Webb supposed, in use was often adulterated by the carelessness of overseers and laborers, by admixtures of the worthless olive earth. Still, the application as manure has had very good effect. A large quantity of this particular body has been dug and used; but it has since been abandoned, because of the greater value of and more convenient access to other more recently discovered beds, which will presently be noticed. At Northbury, as Professor Rogers supposed and reported in 1835, "the precise point was determined at which the eocene first makes its appearance above the water line" of the Pamunkey. But it has been since found at Mr. Waring's farm, about 4 miles lower, as well as at Waterloo, another part of Mr. Webb's estate, about two miles lower than the first diggings at Northbury.

By using the borer in low places, but where no sign of marl was visible on the surface, Mr. Webb has since discovered the eocene marl which will be next described, at various points in a line stretching through the middle of his large estate, and furnishing a convenient supply to each of the three farms. At several distant points, large pits have been dug, which are sunk from 16 to 20 feet deep in the solid marl, without reaching bottom or showing any change of the lower of the two kinds of marl. The pits are worked quite dry; but no marl having been dug for some time before my visit (May 1842) the pits were then all full of water to the brim, and there was but little opportunity to examine the marl, except at the upper edges, and in the heaps still remaining unspread over a part of one of the fields. However, Mr. Webb had before selected and kept for me, at my request, fair specimens in two large lumps of marl from one of the largest and deepest pits, from which my analyses were made. The one, a specimen of the upper 8 or 10 feet of depth, is full of large fragments of shells, generally very soft and much decayed, and with very few whole shells, except

those of the oyster kind. Below this stratum, the marl (as shown by the sample) has no shells or considerable fragments, is of dark gray color and homogeneous texture, like coarse sand united in a mass by barely enough of clay to serve for that purpose. This apparent texture belongs to most of the Pamunkey marls, and is caused by the shelly matter being so pulverized as to be in fact a coarse calcareous sand. The specimen of this lower stratum, of which 8 or 10 feet depth had been exposed, contained in 100 grains, 35.50 of carbonate of lime; and the upper (shelly stratum) 35. The green-sand in both kinds appeared to be in less proportion than in the marl of the river bank at Northbury, and elsewhere along the river generally. Probably there was not more than 20 per cent. at most. The upper stratum, and larger part as used, of this marl, through a line of several miles in length, is very different in appearance from all the other marls seen on the river. And it must also be different in geological age or manner of original deposition, as the shells show much difference. Very few of the *cardita planicosta* were found in the heaps of marl, (which always offer the best exhibition of shells for collection,) and those of very small size, and no saddle oysters. On the other hand, several shells were found, not observed by me at any other place; and one of them, an oyster shell of large size, of remarkable and peculiar form, and in excellent preservation, is very abundant. Though various in form, as are all the ostreas, this, or the more convex of its two valves, has a general peculiarity in a large and sharp hump on the back, and sometimes two such humps. Another *ostrea*, of which the shell is very thin and very convex, and the outline of the valves nearly circular, is here abundant, and as large as two inches across. No specimen of the same had ever been seen by me, except perhaps a few at Newcastle of size so small that the identity was doubtful. The striking differences of kind and of proportions of the shells at Mr. Webb's more recent diggings would be highly interesting to any person possessing that knowledge of geology, and its auxiliary science, fossil conchology, to which I have no claim, and make no pretension. I have done, however, all in my power, to increase the facilities of future competent investigators, by collecting and preserving specimens for their examination. My cabinet contains not only some of all the shells that I have found, or have been able to obtain from the several kinds of marl, but also specimens of all the marls of peculiar and marked character, with their localities accurately distinguished. And the time and the labor which I have given to making the collection, with opportunities possessed by but few other individuals, may thus serve greatly to advance the pursuits of scientific and truly competent investigators.

In the river bank of Mr. Carter Braxton's farm, immediately above the Newcastle ferry, there commences a rapid decrease of the thickness of the calcareous or marl stratum proper, which is substituted by an equal increase or rising of the under-lying green-sand earth. A little above the ferry, the marl is at least 10 feet thick; at less than a mile above, the thickness of the marl is only 5 feet; and at the next large exposure, on the adjacent farm of Mr. B. Tomlin, the marl is not more than 2 or 3 feet thick, over-lying green-sand earth marked with a few scattered and small shells, rising to nearly the full usual height of the marl, say 25 feet or more visible above the water. This was as far in regular connexion along the river as I personally examined; but I learned that still higher, the calcareous stratum almost ceases, the lower stratum of green-sand earth occupying nearly the whole visible section. The lower stratum of the body at Spring Garden, Hanover, (Mr. William H. Roane's farm,) next above, is stated in Professor Rogers' Report as containing, in 100 parts—

Carbonate of lime	4
Green-sand	46
Gypsum	3
Silica and alumina	50
	100

The next important locality of marl, and perhaps the most interesting, is South Wales, Hanover, the farm of Mr. William F. Wickham, and which is the highest point of its known existence. Here, as at the western termination of the green-sand in Petersburg, the bottom is seen, the under-lying stratum being gravelly sand mixed with rounded pebbles. This marl, as seen in several places where very large excavations had been made to marl both the South Wales and North Wales farms, differs altogether in appearance, and greatly in constitution, from all the kinds below. The bed is about 10 feet thick, is generally of uniform dark (nearly black) color, except for being intermixed throughout with large fragments of white shells. At one place, the upper stratum of the marl is yellow or pale reddish instead of black, but similar in the appearance of shells. Specimens of these marls carefully selected on the places in 1840, and analyzed, gave the following results:

From South Wales, (William F. Wickham's land,) Hanover county, 100 grains of upper stratum, yellowish, consisted of

Carbonate of lime	36
Silicious sand and green-sand together 47—of which green-sand appeared to be one-tenth or	4.70
and silicious (or quartz) sand	42.30
Yellow clay and loss	17

100 grains blackish marl, lying below the last—

Carbonate of lime	44
Green-sand	8

100 grains similar to the last, from a different digging—

Carbonate of lime	32.50
Green-sand	22

From North Wales, Caroline county, Williams Carter's land,

100 grains of like blackish marl contained—

Carbonate of lime	37
Green-sand	24

These specimens, which were supposed to present a fair average of the whole body, show an unusually large proportion of carbonate of lime for the Pamunkey eocene beds, and a less proportion of green-sand. To the happy combination of the two manures, I cannot but ascribe the remarkable success of Mr. Wickham in fertilizing his land. Still, he deems the green-sand ingredient of so little worth, compared to the calcareous, that he he would prefer that his marl should have had none of the former substance, provided an equal quantity of calcareous matter could be substituted.

In a former publication, I have presented at length both the facts and my opinions of the peculiar operation of the green-sand marls of the Pamunkey.* It is therefore enough to say here, that the operation of this compound manure is greater than of any quantity of either one of the two enriching materials of which it is composed. In smaller quantity than is usually applied of calcareous marl, it produced equal or greater effect, and was more especially beneficial to clover. The heaviest quantities also applied (as in the practice of Mr. Wickham,) caused no loss; though the like large quantities

* See more full statements at pp. 679 to 691, vol. viii. Farmers' Register.

of merely calcareous marl would have been certainly either wasteful of the manure, or injurious to the land.

Many specimens of these Pamunkey marls and of the lower-lying green-sand earth were subjected to a partial red heat, for the purpose of showing whether suffocating sulphureous fumes were disengaged, as was stated above (page 215) to be the case with some of the James river green-sand earth. The lower stratum (very slightly calcareous) of the Pamunkey marls, from Newcastle ferry, and at J. W. Tomlin's bank, gave out such fumes, but not so powerfully as the dark gypseous earth of Coggins Point. The next higher calcareous and green-sand stratum of J. W. Tomlin's, and the same kind at Piping Tree ferry, and the blackish marl at South Wales, all yielded these strong fumes, but in a still less degree. Sundry other specimens of calcareous green-sand marl which were thus treated, yielded no fumes. The latter results were found in specimens from the several diggings at Newcastle, (both sides of the river,) and at G. W. Bassett's bank. It may not be useless to repeat here, and thus to place in connexion with these results, that all the dark green or blackish earth (*D*) of Coggins Point gave out these suffocating fumes, and also the gray clay (*E*) below, and most powerfully—and that no such product was found from any of the very shelly bands. Thus it would seem that most generally the non-calcareous earths (or nearly non-calcareous) gave out fumes, and the calcareous not. But exceptions were found to both. And of the New Jersey green-sands, containing no carbonate of lime, six specimens were tried at red heat, of earths most esteemed for manure, and not the slightest disengagement of such fumes was produced.*

Of green-sand as an ingredient of miocene marls.

In a previous page, (199,) the presence of green-sand in miocene marls, as an important and general ingredient, was denied; and the subject then passed by, with the promise of its being subsequently resumed. Having treated of the gypseous earth and of eocene green-sand marls, of both of which green-sand forms large and important proportions, it is now most appropriate to inquire into the alleged extent and operation of this substance in miocene marls.

In 1834, Professor William B. Rogers (then a resident of lower Virginia) announced that he had discovered green-sand to be a considerable ingredient of nearly all the many ordinary miocene marls which he had examined either in place or by specimens; and from which observations he inferred the same admixture to be general as to other miocene marls; and that the proportions of green-sand so contained were large enough to form useful additions to, and in some cases the most valuable portion of the manuring ingredients of such marls, (Farmer's Register, vol. ii., p. 129.) At a later time, he added to like general opinions and statements the following: "In some of these deposites [marl beds in the vicinity of Williamsburg,] so large a proportion as thirty and in some specimens forty per cent. [of pure green-sand] has been found; and in cases like this, if we are to trust to the experience of New Jersey, a very marked addition to the fertilizing power of marl must be ascribed to the presence of this ingredient." (Farmer's Register, vol. ii., p. 747.) In a subsequent communication to the Phi-

* The New Jersey "marls" thus tried were selected by the writer from the pits of Josiah Heritage and Thomas Bee of Gloucester, and Henry Allen, Allen Wallace, J. Riley, and J. Cauley, Salem county. The same results were found as to the poorer (or less valued) overlying strata of Heritage, R. Dickenson, J. Cauley, and also of the barren green clay or subsoil. See all described in my report on the New Jersey green-sand earths, Farmers' Register, vol. x. p. 429.

losophical Society of Philadelphia in 1835, and again in the first report of the geological survey of Virginia, the material parts of the above statements are re-asserted, in substance, and nearly in the same words. These statements and opinions were received, when announced, as undoubted, and they have not since been questioned in any publication; nor have they since been either confirmed by any additional proof or testimony, nor have they in direct terms been modified or retracted by their author. Yet the correctness or incorrectness of the assertion of such abundance and general diffusion of green-sand in the miocene marls of Virginia is a matter of great interest—and, in its bearing on the application of marl and the rationale of its operation, of great importance to agricultural improvement. It is certain that to this day, many proprietors consider that their marls are peculiarly valuable because of the supposed large proportions of green-sand therein—such opinions being founded either on the publications, or, with still more confidence, upon the personal examinations and verbally expressed opinions of the state geologist.

My own personal examinations of marls in place, and analyses of specimens of other beds, have been very extensive; and my attention has been given especially in regard to this point to sundry specimens, including several of the particular bodies of marl which it is understood that Professor Rogers had pronounced to be very rich in green-sand—containing, say, 20 to 30 per cent. of the black granules so called. I have found some green-sand (but generally in very small proportion,) in nearly all the specimens examined particularly for this substance; and believe that Professor Rogers was correct so far as inferring that it is a very frequent ingredient. And for the first observation of this curious and interesting fact he is justly entitled to the entire credit. To such extent as green-sand is present, and according to the manner of the operation of that earth, (whatever that may be,) the green-sand in the miocene marls must be effective and useful. But whether such effect be of any distinguishable and appreciable value, or not, depends on the quantity and proportion of green-sand in the marl; and, so far as all my experience and observation enable me to judge, I cannot but believe that the above stated estimates of quantities and proportions of green-sand are greatly exaggerated, and extremely incorrect and delusive. I do not mean to assert, and cannot be expected to prove, the *negative* of the assertion of such abundance of green-sand. But, from all my means for arriving at conclusions, it is my confident belief that but few of the bodies of miocene marls in Virginia contain as much as 2 per cent. of green-sand—if even as much as 1 per cent.; and that an average proportion, throughout any considerable digging for manure, of as much as 5 per cent. of green-sand is extremely rare. The largest proportion (estimated by the eye) that I ever found was supposed to be 5 per cent.; and that was in a very peculiar marl, found at Coggins Point farm and elsewhere in that neighborhood, or rather a loose calcareous sand, which forms the over-lying layer of compact blue marl. This sand contains only about 20 per cent. of finely divided shelly matter, and the whole mass would appear, to slight observation, similar to and as poor and as loose as the deep sands of the roads through a sandy country. But few persons would have used this sand for manure—or would have dignified it by the name of marl. However, the ease with which it could be worked, and the necessity for removing it to uncover the better marl below, induced me to carry out and apply it as a second dressing to an adjacent part of a field which had been just before marled. The effects were so marked, and so superior to the single marling, that I was ready to believe that the green-sand caused the difference. The loose calcareous sand mentioned at page 201, which one of my neigh-

bors supposed (from its good effects) to be rich in calcareous earth, is precisely like mine in general appearance, and in position in the bed; and appears to have a like unusually large proportion of green-sand, which no doubt served to produce part of the benefit which was ascribed wholly to the carbonate of lime. This peculiar deposite furnishes the only cases known to me of a miocene marl being rich enough in green-sand for the benefit from the latter to be known. And even this benefit would not have been distinguished or suspected, but that the poverty of the earth in calcareous matter required it to be applied very heavily. The much thicker body of compact marl, lying under this poor calcareous sand, contains (by supposition) not so much as 2 per cent. of green-sand.

But it is true, that when attention was not particularly directed to green-sand, proportions not exceeding 5 or 6 per cent. might have escaped the notice of one who had handled and examined the specimens of marl, or who even analyzed them, merely with a view to their proportions of calcareous matter. But proportions so large as 40, 30, or even 20 per cent. of green-sand could not thus escape even careless and superficial observation; for even the smallest of these proportions would give a very manifest greenish or gray tint to any otherwise light-colored marl. Knowing the great uncertainty of the *guessings* at proportions of green-sand naturally intermixed with marl or other earth, I did not rely on them except as to the *absence* of any very large proportion. For more accurate testing, the clayey parts were washed off in water; in others the calcareous parts were also removed by weak acid. And for still better means of judging by comparison, I mixed together, in different known proportions, measured quantities of light-colored marl (such as are all those about Williamsburg,) and pure green-sand prepared by washing some obtained from the richest beds in New Jersey. And of such artificial compounds, examined by the eye both when dry and in powder, and wet, and also after being again dried in mass, the admixture of green-sand, even when as small as 10 per cent., was obviously more abundant than in the miocene marls reputed to be among the richest in green-sand. Under these circumstances, without denying the possible existence of such cases, it is proper to wait for and to require further proof of such large proportions as 20 to 40 per cent.

But there is much better support for my position, of the general scarcity of green-sand in miocene marls, than any proofs, positive or negative, that I can adduce, presented by Prof. Rogers himself in his 'Report of the progress of the Geological Survey' for 1837. He therein gives a tabular statement of 148 specimens selected by his assistants, and their analyses made under his own direction. It is to be presumed that so many specimens, and thus obtained, must present a fair and correct average of general quality of the marls of the region in which they were found; or at least that their contents would not be too little favorable to the geologist's preconceived opinions. The specimens were from 18 counties, viz.: Lancaster, Westmoreland, Richmond, Northumberland, King George, Mathews, Middlesex, Gloucester, King and Queen, King William, Essex, Isle of Wight, Nansemond, Elizabeth City, Surry, Prince George, James City, and Warwick. Of these 148 specimens, of one only (S. Downing's, Lancaster,) is the quantity or proportion of green-sand stated with any approach to precision. This is said to contain "10 or 12 per cent. of green-sand," and only 17 per cent. of carbonate of lime. Of five others, the green-sand would seem to be in notable quantities, but as no numbers or proportions are named, it may be inferred that the proportions were deemed less than the one just stated. These five are described as follows, in regard to this ingredient: Callahan's, Lancaster, "large grains of green-sand in considerable quantity;" Gloucester Town, "richly specked with green-sand;" Saunders', Isle of Wight, (one only of

three strata,) "considerable green-sand." Stith's, Surry, "quite richly specked with green-sand." A. C. Jones', Surry, and at Kingsmill, James City, "intermixed with green-sand." Now what proportions these descriptions designate, it is not for me to determine; but 3 or 4 per cent., at most, would abundantly serve to meet all their requisitions. There are also 7 other of the specimens named marked in less degrees by the presence of this ingredient, and which are described in this respect in such phrases as these: containing "a little green-sand"—"specked with green-sand"—"quite perceptibly specked with green-sand"—"tinged with green-sand"—and "slightly intermixed with green-sand." There remain of the list 135 other specimens, of which 48 are stated to contain of "green-sand *a trace*," (by which term chemists understand a proportion so small that its presence is barely certain,) and of the other 87 specimens no green-sand is mentioned, and therefore it may be inferred that not even "a trace" could be found.

If this list of marls and statements of their fertilizing contents had been presented by the author distinctly as a designed refutation of his previously and repeatedly published opinions of the frequent abundance and general presence in useful quantity of green-sand in miocene marls, nothing could have been more to the purpose, or more conclusive.

Nevertheless, few and rare as may be the cases in which the value and beneficial effects of marls are increased in any considerable degree by the presence of green-sand, or of any other ingredient than carbonate of lime, it is important that such auxiliary fertilizing matters should be searched for, and their absence or presence known. The great value and uniform fertilizing effects of *carbonate of lime* will be the most highly appreciated by those farmers who understand and estimate them separately and alone; without confounding the operation of that manuring earth with those of any other intermixed and unknown substances, no matter what increase of benefit such intermixture may produce in particular cases.

KNOWN SHELLS OF THE MARLS OF LOWER VIRGINIA.*

Miocene.

Astarte undulata, *Say.*
" concentrica, *Conrad.*
" vicina, *Say.*
Artemis acetabulum "
Arca incile, *Say.*
" centenaria, *Say.*
" limula, *Con.*
" idonea "
Ballanus——?
Buccinum porcinum, *Say.*
" obsoletum "
" laqueatum "
" altile, *Con.*
Cardium laqueatum, *Con.*
" Virginianum "
Chama congregata, *Con.*
" corticosa, "
Corbula cuneata, "
" inequale, *Say.*
Crassatella undulata, *Say.*
Carditamera arata, *Con.*
Cardita granulata, *Say.*
Cytherea reposta, *Con.*
Crepidula aculeata, *Lamarck.*
" fornicata "
Conus——?
Dentalium thallus, *Con.*
Dispotæa costata, *Say.*
Fusus quadricostatus, *Say.*
" cenereus "
" exilis, *Con.*
Fissurella, ——?
Fasciolaria mutabilis, *Con.*
Gnathodon cuneatum, *Gray.*
Isocardia rustica, *Sowerby.*
Lucina divaricata, *Lam.*
" contracta, *Say.*
" anodonta, "
" cribaria, "
" squamosa, *Lam.*
Lithodendron lineatus, *Con.*
Murex umbrifer, *Con.*
Mactra delumbis, "
Marginella——?
Natica heros, *Say.*
" duplicata, *Say.*

* I am indebted to my friend M. Tuomey for this list of the *known* tertiary shells in my collection. There are also sundry other species or varieties which are doubtful or undetermined, and therefore are not here enumerated.

Ostrea Virginiana, *Gmel.*
" subfalcata, *Con.*
Oliva litterrata, *Lam.*
Pandora crassidens.
Panopæa reflexa, *Say.*
Petricola centenaria, *Con.*
Plicatula marginata, *Say.*
Pecten Jeffersonius, *Say.*
" Madisonius
" septemnarius "
" decemnarius, *Con.*
" Virginianus, *Con.*
Pecten Clintonius, *Say.*
" eboreus, *Con.*
Pectunculus subovatus, *Say.*
" pulvinatus, *Lam.*
Perna maxillata, "
Pleurotoma —— ?
Serpula —— ?
Teredo —— ?
Turritella.
Venus tridacnoides, *Lam.*
" Rileyi, *Con.*
" alveata, *Con.*

Eocene.

Cardita planicosta.
Corbula Alabamienses, *Lea,*
Crassatella—— ?
Ostrea sellæformis, *Con.*
" compressirostra, *Con.*
Pecten Lyelli, *Lea.*
Panopæa oblongata, *Con.*
Rostellaria velata. "
Turritella Mortoni. "

Erratum in Professor Shepard's letter, p. 222, line 39, for "nutritive," read MINERAL.

NOTE V.

THE EARLIEST KNOWN SUCCESSFUL APPLICATIONS OF FOSSIL SHELLS AS MANURE.

The two old experiments described at page 70, though the only applications of fossil shells known to me previous to the commencement of my use of this manure, were not all that had been made, and, which being deemed failures, had been abandoned and forgotten. Another, within a few miles of my residence, was brought to light and notice afterwards, by an old negro, who was perhaps the only person then living who had any knowledge of the facts. After I had found enough success in using this manure to attract to it some attention, Mr. Thomas Cocke of Aberdeen was one of those who began, but still with doubt and hesitation, to use marl to some considerable extent. One of his early applications was to his garden. The old gardener opposed this, and told his master that he knew "the stuff was good for nothing, because, when he was a boy, his old master (Mr. Cocke's father) had used some at Bonaccord, and it had never done the least good." Being asked whether he could show the spot where this trial had been made, he answered that he could easily, as he drove the cart which carried out the marl. The place was immediately sought. It was on the most elevated part of a very poor field, which had been cleared and exhausted fully a century before. The marled space (a square of about half an acre) though still poor, was at least twice as productive as the surrounding land, though a slight manuring from the farm-yard had been applied a few years before to the surrounding land, and omitted on this spot, which was supposed, from its appearance, to have been the site of some former dwelling house and yard, of which every trace had disappeared except the permanent improvement of the soil usual from that cause. A close examination showed some fragments of the hardest shells remaining, so as to prove that the old man had not mistaken the spot. This, like other early applications, had been made on ground too poor for the marl to show but very slight early effect; and as only one kind of operation of any manure was then thought of, (that which dung produces,) it is not strange that both the master and servant should have agreed in the opinion that the application was useless, and that all persons who knew of

the application remained under that opinion until almost all remembrance of the experiment had been lost.

Since the printing of the previous pages in which references were made to the earliest application of marl in Virginia, I have obtained some further information thereupon, which, however imperfect, may yet be interesting. In a recent conversation (1842) with William Short, esq., now of Philadelphia, the son of Major William Short who made the experiment, he told me that he well recollected when his father's first and accidental discovery of marl was made on the Spring Garden farm in Surry, (in digging a ditch across a wet swamp,) and his sanguine and confident anticipations of deriving from its use great improvement and profit. Mr. Short further stated that he was then so young, and always so litttle acquainted with agriculture, that he did not know what were the precise facts in regard to the failure of his father's experiment and hopes; but he well remembers that the result was deemed an entire failure, and that it caused total disappointment.

Such a conclusion I had supposed before being so informed. I had also inferred, and no doubt correctly, that the supposed failure and truly slight benefit, and the mistaken deductions from the results, were such as have been stated. I have since written to the present proprietor of the land, Francis Ruffin, esq., to obtain the latest information concerning the results of this application, now some sixty-five years old; and the most recent effects, as learned from him, will be here stated in connexion with the earlier, which will be repeated.

It was before said (page 70) that this old marling (of about 10 acres) was done on poor sandy land, kept (as was the then universal course of tillage) under exhausting culture and close grazing for many years thereafter; that from 1812 the treatment had been lenient; and that in 1819, the superiority of the marled part was visible, and that part of the outline could be then distinctly traced. In 1834, Mr. F. Ruffin applied to this and some acres of adjoining land, pine leaves at the rate of 75 one-horse cart loads to the acre. The benefit from this vegetable cover was so much greater on the marled part, that the superior growth of the next crop of corn and of the succeeding crop of wheat, "marked out the limits of the old marling very conspicuously." The whole was sown in clover in the spring while under wheat; that on the marled part lived and stood pretty well, while nearly every plant of clover on the part not marled died in the course of the year. In 1837, the whole field was marled, without excepting the old marled part; and the whole was again littered with pine leaves. The crops of corn and wheat since have shown less improvement from these applications on the piece thus re-marled, than on the adjoining land then marled for the first time. Indeed, the recent and additional increase of corn and wheat, since re-marling has been very little. These results, early and late, are precisely such as might have been anticipated from the action of calcareous manures, and the condition of this land and its management.

Another experiment of marling, made earlier than my first, by Mr. Richard Hill, in King William county, has been heard of since the publication of the last edition, and of which the circumstances were given at length at pages 22 and 27 of vol. ix. Farmers' Register, to which the reader is referred. It is enough here to state, that the effects were beneficial at first; but so injurious (because of the excessive quantity) on several succeeding crops, that this trial also was deemed a failure, and the marling a source of loss; and there was no repetition of marling in that neighborhood until about 1820, when other and better views began there to be first entertained.

There was also successful and continued use of this manure in James

City county, in Virginia, made earlier than mine; and still earlier by the Rev. John Singleton, in Talbot county, Maryland. It appears that the early (though chance-directed) combination of putrescent manures with marl, in both these places, served to prove the value of the latter, and perhaps to prevent it being there also abandoned as worthless, as in the other cases. But though the application was continued, and with great success and profit, the knowledge of these facts and the example extended very slowly; and the then want of communication among farmers kept all ignorant of these practices for years, except in the immediate vicinity of the commencement of each. I have since endeavored to ascertain the time of the first applications in James City, and have been informed that it was in 1816. Mr. Singleton's, in Maryland, were begun as early as 1805. His own account of his practice (which will be annexed, as an interesting statement of the earliest profitable use of this manure,) was first published in 1818, in the 4th volume of the Memoirs of the Philadelphia Agricultural Society, (page 238.) The date of his letter is Dec. 31, 1817. My first experiment was made the following month, (Jan. 1818.) but more than a year before I met with Mr. Singleton's publication, or had heard of any application of fossil shells, except the two failures mentioned in page 70. But, however beneficial may have been found the operation of marl in Talbot and in James City, it is evident, from Mr. Singleton's letter, and from all other sources of information, that the mode of operation remained altogether unsuspected by those who used it; and this was perhaps the principal cause why the practice was so slow in spreading. It is now [1835] thirty years since the first proofs were exhibited on the land of Mr. Singleton; yet, according to the report of the geological survey of the lower part of Maryland, (submitted to the legislature of Maryland at its recent session of 1834--5,) it appears, though the value of marl is well understood, and much use of it made in Talbot county, and part of Queen Ann's county, yet that almost no use has been made of it on the other and much more extensive parts of the Eastern Shore of Maryland—and none whatever west of the Chesapeake in that state, where it is found in abundance. Such at least are the inferences from Mr. Ducatel's report, though in part drawn from indirect testimony, more than direct and particular assertions.

The slight, and almost contemptuous manner, in which marl is mentioned by so well informed an agriculturist as Taylor, as late as 1814, when his *Arator* was published, (and which remained unaltered in his 3d edition of 1817,) proves that almost nothing was then known of the value of this manure. All that seems to relate to our abundant deposites of fossil shells, or to marl generally, is contained in the two following passages:

"Without new accessions of vegetable matter, successive heavy dressings with lime, gypsum, and even marl, have been frequently found to terminate in impoverishment. Hence it is inferred, that minerals operate as an excitement only to the manure furnished by the atmosphere. From this fact results the impossibility of removing an exhausted soil, by resorting to fossils, which will expel the poor remnant of life; and indeed *it is hardly probable that divine wisdom has lodged in the bowels of the earth the manure necessary for its surface.*"—*Arator*, p. 52, *2d edition, Baltimore.*

"Of lime and marl we have an abundance, but experience does not entitle me to say any thing of either."—*Id.* p. 80.

From the Rev. John Singleton, to the Hon. Wm. Tilghman.

* * * * * * * * * *

"Your first question is, 'whether what I use be marl, or soil mixed with shells?'

"Whether it be marl or not, I will not pretend to determine, as I have seen no de-

scription of marl that answers exactly to it; but Mr. Tench Tilghman informed me he had seen a description of marl used in Scotland, exactly similar to what I use on the farm on which I reside, and which is the improved land you mention. I have not seen the account myself. However, this, and all mixtures of broken marine shells, of which there is a great variety, are now denominated marl, here. What I consider the best, and which I most use, is composed of small parts of marine shells, chiefly scallop shell, about one eighth of an inch square, or somewhat longer or smaller, with scarce any sand or soil with it; some of it seems to be petrified, and is dug up in lumps, like stone, from four or five, to forty or fifty pounds in weight, hard to break even with the edge of an axe, and will remain for years, tumbled about with the plough, before it is entirely broken to pieces, and mixed with the soil; indeed you may observe it in some parts of the bank, where the soil has been washed from it, appearing like rock stone; but if broken and pulverized a little, it effervesces very much with acids. * * * * *

"I have applied it to all the soils on my farm, some of which is a cold white clay, and wet; others a light loam, and sandy. I find it useful to each kind, and manure my land all over with it, without distinction, and to advantage; putting a smaller quantity upon the looser soils. I have applied it as a top dressing on clover, and also where clover has not been sown, with a view to improving the grass, and also to be satisfied whether it would not be best for the ground, to let it lie spread on the surface, for a year before the ground was put into cultivation. But it has not answered my expectation. I could not perceive any advantage from that mode of application. I now constantly apply it to the ground cultivated in corn; carting it out in the winter and spring, and putting on from twenty to forty cart loads per acre, according to the ground, and the previous quantity that had been put on, in former cultivations, dividing each load into from four to eight small heaps, for the greater ease in spreading, according to the size of the load. Some is put on before, and some after the ground is broken up, but it is all worked into the soil by the cultivation of the corn, and it never fails of considerably improving the crop of corn, as also the ground wherever the marl is, especially in largest quantity. There is a small green moss, and black moist appearance, on the surface of the ground, when not cultivated; as you perceive about old walls, and in strong ground. Though the preceding is the common mode in which I use the marl, I do not think it the best; I mix some in my farm yard, with the farm yard and stable manure; and would prefer mixing and applying all that I use thus mixed, but for the labor of double cartage which I cannot as yet accomplish, manuring so largely as I do. I cultivate one hundred acres yearly, and constantly manure the whole of what I cultivate; employing only four carts, and four hands with the carts, which do all the manuring and carting on the farm.

"Your next question is, 'what has been my rotation of crops, and mode of cultivating, since I have used this manure?'

"Since I began to use the marl, and bend my attention to improvement by manure, I have cultivated only corn and wheat, sowing my ground in clover, and using the plaster. Instead of cultivating all my ground in corn, and sowing wheat on it as heretofore, I divided my cultivation into two parts, of fifty acres each, putting one part into corn, which I was able to accomplish manuring time enough for the corn, and making a fallow of the other part, manuring as much of it as I could accomplish before the time for sowing wheat; and disregarding, in a degree, all smaller crops, which I could not attend to, as an object, without increasing my number of hands, and interfering with the main business. I went on in this manner, till I found I could easily accomplish manuring one hundred acres and upwards, per annum. Having got my ground to that state that I can risk making a crop without manure, I am now about discarding fallow, being able to manure my whole hundred acres time enough for cropping in the spring, by beginning to manure for the next year as soon as the spring manuring is finished. I shall in future have no wheat in fallow, but sow it after corn and other crops, from which I am satisfied I can make more from my ground than by naked fallow, which I always considered unprofitable, though you made more wheat, except for the advantage of having more time to manure. * * * * * * * *

"In saving my corn crop, I cut it up without pulling it from the stalk as usual, and cart it in all together, then husk it out, leaving the husk to the stalk: I lay these near my feeding yard, and throw them into it twice a day: this gives us a large quantity of strong healthy food for the cattle, which serves them all winter, and keeps them in good condition without any other food; makes a large quantity of excellent manure, and a fine dry feeding yard. As opportunity can be found, we cart marl, fuller's earth, clay, and any good soil that is convenient, into this yard, which being mixed with the stalks, and straw, or any thing else, penning the cattle on it through the winter and summer, instead of penning on the field, in the common way, we have a large quantity of manure to go out in the fall, and next winter; it is put into the field, in the intermediate rows, between the rows of marl, as far as it will go, and they will get mixed in the cultivation. We also convert the scouring of our ditches, the head-lands of the fields, and all waste-ground that we can, into manure, by carting litter, from the woods, yard manure, or

litter, &c., and mixing with them; so that I can nearly, or quite, now, accomplish making farm-yard and this kind of manure, sufficient to go over my whole hundred acres, annually. For the two last years, I have made more manure than I could accomplish or effect carrying out, though I have manured from ten to twenty acres more than my hundred, each year, with part marl and part farm-yard, but not the whole with both, as I hope to be able to do in future; but it will be necessary to increase my carting force to effect it, and I clearly see I can raise sufficient manure for the purpose; heretofore I have manured my corn-ground, fifty acres, with marl, and my fallow with part farm-yard manure, and part marl, as mentioned before; so that you will perceive the improvement made on my soil has not been effected by marl alone, but in conjunction with farm-yard manure, clover and plaster, and by making it a point to manure with something all the ground I put into cultivation; so that every time I cultivated a field, that field was improved, and not in any degree impoverished by the cultivation. By this means, and the Divine assistance, I have effected that improvement of my farm, which is so very striking to the observation of every person acquainted with it. * * *

"In August, 1805, in digging down a bank on the side of a cove, for the purpose of making a causeway, I observed a shelly appearance, which it struck me might improve clay soil; I took some of it immediately to the house, and putting it into a glass, with vinegar, found it effervesced very much; this determined me to try it as a manure; accordingly, in September, I carted out about eighty cart loads, and put it on a piece of ground, fallow, preparing for wheat, trying it in different proportions, at the rate of from twenty-seven to about a hundred loads per acre, and the ground was sown in wheat. I could not, myself, be satisfied that there was any difference through the winter and spring, although General Lloyd, who was viewing it with me in the spring, thought he could perceive some difference in favor of the marl; but at harvest time, the wheat, though not more luxuriant in growth, or better head, was considerably thicker on the ground; and after the wheat was taken off, the ground where the marl had been put was set with white clover, no clover being on the ground on either side of it. The next year, 1806, I discovered it in the drain into the head of the cove, which I immediately ditched, and from the ditch put out seven hundred loads, on the fallow ground. The effect, as to the wheat and clover, was the same, (this was put, for experiment, at the rate of from forty to a hundred and twenty cart-loads per acre,) though the marl was not of the same kind as the other, but more mixed with sand and surface soil, being taken from the low ground, by ditching, and all mixed together. I also tried it on corn ground, spread out as above mentioned, and found the effect immediate, as to the corn; and in the same manner as above described, as to the wheat sown on the corn ground. This induced me to persevere in the use of it, which I have done ever since, adopting the mode I mentioned before, and putting it at first from forty to seventy loads per acre, till I have now come down as low as eighteen or twenty loads per acre, going the third time over the ground with it. * * * * * * *

NOTE VI.

FIRST VIEWS WHICH LED TO MARLING IN PRINCE GEORGE COUNTY.

(*From the Farmers' Register, Nov.*, 1839.)

Among the persons who have read with interest the 'Essay on Calcareous Manures' and have received as sound the novel theory and doctrines there maintained, several have expressed their curiosity which had been excited to learn the earliest facts, or the train of reasoning, which led to the suggestion of the cause of the defect of naturally barren soils, and the remedy. Such inquiries have been made of the writer by persons of investigating and well informed minds, but of very different education and pursuits; and they were pleased to say, in regard to the concise verbal answers made to their inquiries, that they deemed the details likely to be interesting to many, and that if given to the public, they might serve better to induce the consideration and enforcement of the doctrines, than had been done by the mere arguments which had been already published, convincing as they considered the arguments to be.

Though, without these reasons and solicitations, the writer might have still refrained from touching this subject, it was not that he had not held the same opinion, and, except in his own case, would have urged the same course. It is certain, that the tracing of the steps by which any new discovery or improvement is reached, must always be interesting in proportion to the admitted importance of the results; and indeed such a statement seems almost necessary to induce the reader to accompany the author from his first premises to the remote conclusion, and which otherwise is only reached through a devious and tedious passage, and by a course of reasoning which is wanting in interest, because the application and tendency of the arguments and proofs are not seen when they are first presented. The objection which restrained the writer from before pursuing a course which he would have highly approved in others, was, that such a narrative of opinions and facts would be entirely a personal narrative, and therefore obnoxious to the charge of egotism throughout. The statement of the reasoning which led to the successful use of fossil shells on the poor lands of lower Virginia, would be incomplete if not accompanied by a narrative of early labors, and the early as well as latest results and effects. In the whole of this, there would be scarcely any thing but statements of what the writer thought, and reasoned, and performed. But the subject must be so treated, or not at all; and having consented to give the narrative, the writer will throw aside all scruples and objections, and endeavor to enter as much into detail, as he, if a reader of others' agricultural improvements and practical operations, would desire there to find.

With the beginning of the year 1813, when barely nineteen years of age, the easy indulgence of my guardian gave to me the possession and direction of my property; which consisted of the Coggins Point farm, with the necessary and yet very insufficient stock of every kind. It is scarcely necessary to add that, at my very early commencement, I was totally ignorant of practical agriculture; and such would have been the case, according to the then and now usual want of training of farmers of Virginia, even if my farming labors had been postponed to a mature age. But I had always been fond of reading for amusement, and the few books on agriculture which I had met with had been studied, merely for the pleasure they afforded, at a still earlier time of my boyhood. The earliest known of these works was an English book, in four volumes, the 'Complete Body of Husbandry,' of which I have not seen the only known copy since I was fifteen years old. This work was probably a mere compilation, and of little value or authority; but it gave me a fondness for agricultural studies, and filled my head with notions which were, even if proper in England, totally unsuitable to this country. 'Bordley's Husbandry' next fell into my hands, and its contents were as greedily devoured. This was indeed written in America, and by an American cultivator; but as he drew almost all his notions from English writers, his work is essentially also of foreign materials.

Thus prepared, I commenced farming, ignorant indeed, but not in my own conceit. The agriculture of my neighborhood, like all that I had ever witnessed, was wretched in execution, and as erroneous as well could be in system, whether subjected to the test of sound doctrine, or the improper notions which I had formed from English writers. I was right in condemning the general practice of my neighbors; but decidedly mistaken in my self-satisfied estimate of my own better information and plans.

Just about the time that my business as a cultivator was commenced, Col. John Taylor's 'Arator' was published; and never has any book on agriculture been received with so much enthusiastic applause, nor has any

other had such wide-spread early effects in affecting opinion, and stimulating to exertion and attempts for improvement. The ground had before no occupant, and therefore this work had to contend with no rival. The larger land-owners, of lower Virginia especially, had previously treated their own proper employment, and their only source of income, with total neglect; and very few country gentlemen took any personal and regular direction of their farming operations. It was considered enough for them to hire overseers, (and that class then was greatly inferior in grade and respectability to what it is now,) and to leave the daily superintendence to them entirely. The agricultural practices, and also the products, were consequently, and almost universally, at a very low ebb. The work of Taylor appeared when these evils had become manifest; and it was received with a welcome which in warmth was proportioned to the magnitude of the evil, and to the exaggeration of the promises of speedy and effectual remedy which the author made, with entire good faith no doubt, but which proved any thing but true to the great majority of his sanguine followers.

Of course, I was among the most enthusiastic admirers of 'Arator;' and not only received as sound and true every opinion and precept, but even went beyond the author's intention, (perhaps,) and applied his rules for tillage to lands of surface and soil altogether different from the level and originally rich sandy soils of the Rappahannock, where his labors and system had been so successful. However, this error was by no means confined to myself; for his other disciples fully as much misunderstood the directions, and misapplied the practices.

It was my main object to enrich my then very poor land; and for that, Taylor offered means that seemed to be sure and speedy. According to his views, it was only necessary to protect the arable land from all grazing, and thus let the vegetable cover of the land, when resting, serve as manure—to plough deep, and in ridges—to convert all the corn-stalks and other offal to manure, and plough it under, unrotted, for the corn—to put the farm under clover as fast as manured—and the desired result would be sure. I hoped at first to be able to manure, say 10 or 12 acres a year very heavily, with the barn-yard manure, and expected that such manuring would give a crop of 50 bushels of corn to the acre. The space, so enriched, when in the succeeding crop of wheat, would be laid under clover—and its acquired productiveness be made permanent, by the lenient rotation of two crops only taken from the land in four years. But utter disappointment followed. The manure was put on the poorest (and naturally poor) land; and it produced very little of the expected effect in the first course of crops, and was scarcely to be perceived on the second. Clover could not be made to live on land of this kind; and even on much better, or where more enriched, it was a very precarious crop, and which, where the growth was best, was certain to yield the entire occupancy of the ground to natural weeds after one year. The general non-grazing of the fields under grass, or rather under weeds, produced no visible enriching effect, and the ploughing of hilly land (as mine mostly was) into ridges, caused the most destructive washing away of the soil by heavy rains. These results were not speedily made manifest; and before being convinced of their certainty, I had labored for four or five years in using these means of supposed improvement of the soil, but all of which proved either profitless, entirely useless, or absolutely and in some cases greatly injurious. And even after trying to avoid the first known errors, and using all other supposed means for giving durable and increasing fertility to my worn and poor fields, at the end of six years, instead of having already achieved great improvement, I was compelled to confess that no part of my poor land was more

productive than when my labors commenced, and that on much of it, a ten-fold increase had been made of the previously large space of galled and gullied hill-sides and slopes.

When more correct opinions had been formed in after-time of the actual condition and requirements of such poor soils, it seemed an astonishing delusion, which would have been altogether ludicrous but for its serious effects, that I should have counted so much on improving such a soil, and by such means. With the exception of a small part near the river banks, (perhaps one-fifth of the then cleared and cultivated land,) which had been originally of very fine quality, and, however abused and exhausted, was still good land, the farm generally consisted of a soil of sandy loam, usually about three inches deep, and through which a single-horse plough could easily penetrate and turn up the barren and more sandy subsoil. Grazing the fields, when not under tillage, had been the regular practice; and under it very little growth was to be seen except the light and diminutive "hen's nest grass," which formed the almost universal cover of the poor fields of lower Virginia, in the intervals between tillage. Add to these circumstances of very poor and shallow soil, and barren and sandy subsoil, and almost no vegetable cover to turn under, that every field was more or less hilly, and liable to be washed by heavy rains—and the judicious reader will see nothing but false confidence and ignorance displayed in my bold adoption of Taylor's system. Nor was I convinced of my error until after nearly all the fields had been successively thrown into ridges by two-horse ploughs, and all the hilly and more slightly inclined surface had been awfully washed and gullied, by the exposure of the loose sub-soil to the action of the streams of rain-water.

While these my supposed measures of improvement were in progress, I was in habits of frequent and familiar intercourse with my oldest and best friend, and former guardian, Thomas Cocke, who resided then on his Aberdeen farm, and since and now, on Tarbay, adjoining my own land. My friend was a man for whose mind and mental cultivation I could not but entertain a very high estimation. But though all his life a practical and assiduous cultivator, and finding his greatest pleasure in his farming labors, he yet was a careless, slovenly, and bad manager, and of course an unprofitable farmer. Therefore, on this subject, I held in but light esteem the opinions which he maintained, which were opposed to my own. One of these, (and which he had first gathered from some old and ignorant, but experienced practical cultivators of his neighborhood,) was the opinion that our land which was naturally poor could not "hold manure," to any extent or profit, and therefore could not be enriched. For years I heard this opinion frequently expressed by him, and the evident inference therefrom, that the far greater part of our lands, and of the whole country, was doomed to hopeless sterility; and as often as heard, I rejected it as a monstrous agricultural heresy—as treason, indeed, to the authority of Taylor, and of every other author on agriculture whom I had read or heard of. But at last I was compelled, most reluctantly, to concur in this opinion.

What was then to be done? I could not bear the idea of pursuing the general system of the country in continuing to lessen the already small productiveness of my fields, by their course of cultivation. The whole income, and more, was required for the most economical support of a then small but fast growing family; and for any increase of income or net profit, there was no hope, save in the universal approved resort, in all such cases, of emigrating to the rich western wilderness. And accordingly such became my intention, fully considered and decided upon, and which was only prevented being carried into effect by subsequent occurrences.

Just before this time Davy's 'Agricultural Chemistry' had been published in this country; and I read it with delight, notwithstanding my then total ignorance of chemical science, and even of chemical names, except as learned by that perusal. There was one passage of this author which seemed to promise to afford both light and hope on the point in which disappointment had led me to despair. As an illustration of defects in the chemical constitution of soils, and of the remedies which proper investigation might point out, he adduced the fact of a soil "of good apparent texture," which was sterile, and seemed incapable of being enriched. The fact which struck so forcibly on my mind was presented in the following concise passage of Lect. iv. "If on washing [for analyzing] a sterile soil, it is found to contain the salt of iron, or any acid matter, it may be ameliorated by the application of quick-lime. A soil of good apparent texture from Lincolnshire, was put into my hands by Sir Joseph Banks as remarkable for sterility. On examining it, I found that it contained sulphate of iron; and I offered the obvious remedy of top-dressing with lime, which converts the sulphate into a manure."

Much the greater part of my land, and of all the land of lower Virginia, seemed to me just such as Davy descried in this single and peculiar soil. It was certainly of "good apparent texture," that is, it was neither much too clayey or too sandy, nor had it any other apparent defect to forbid its being fertile in a very high degree. Yet it was and always had been sterile, and, as my experience now concurred with that of my older friend in showing, it could not be either durably or profitably enriched by putrescent manures. Could it be possible that the sulphate of iron (copperas) which Davy found in this soil, and which he evidently spoke of as a rare example of peculiar constitution, could exist in nineteen twentieths of all the lands of lower Virginia? This could scarcely be; and yet, in despair of finding other causes, I set about searching for this one.

It was not difficult, even for a reader so little instructed in chemistry, to apply the test for copperas. It was only necessary to let a specimen of the suspected soil remain soaking in pure water, until any copperas, if present, would be dissolved; then to separate the fluid by pouring off and filtration, and then to add to the fluid some of the infusion of nut galls. If copperas had been held in solution, the mixture would produce a true *ink*, of which the smallest proportion would be made visible in the before perfectly transparent water. But all these first attempts were fruitless, and I was obliged to conclude that the great defect, or impediment to improvement, in most of our soils, was *not* the presence of the salts of iron. But though not a salt, of which one of the component parts was an acid, might not the poisonous quality be a *pure* or *uncombined acid?* This question was raised in my mind, and the readiness produced to suppose the affirmative to be true, by several circumstances. These were, 1st, that certain plants known to contain acid, as sheep-sorrel and pine, preferred these soils, and indeed were almost confined to them, and grew there with luxuriance and vigor proportioned to the unfitness of the land for producing cultivated crops. 2nd. That of all the soils supposed to be acid which I examined by chemical tests, not one contained any calcareous earth.* 3rd. That the small proportion of my land, and of all within the range of my observation,

* I was not then aware, of the important and novel fact which I afterwards ascertained and established, and which is now fully received (with very slight acknowledgment of its source) by the geologists of this country, that *almost all the soils* on the Atlantic slope of this country, and even including nearly all limestone soils, are also entirely destitute of *carbonate* of lime, though that ingredient seems nearly if not quite universal in all the good soils of England and the continent of Europe.

which was *shelly*, and of course calcareous, was entirely free from pine and sorrel, and moreover was as remarkable for great and lasting fertility, as the lands supposed to be acid for the reverse qualities. Shells, or lime, would necessarily combine with, and destroy, all the previous properties of any acid placed in contact; and therefore, if acid were present universally, and acting as a poison to cultivated plants, it seemed plain enough why the shelly lands were free from this bad quality, and by its absence had been permitted to grow rich, and to continue productive. Every new observation served to add strength to this notion; and in our tide-water region generally, and even in my own neighborhood, there were plenty of subjects for observation and comparison, both in small shelly and fertile spots, and a vast extent of poor pine and sorrel-producing lands. Still, I could obtain no direct evidence of the presence of acid, either free or combined, by applying chemical tests to soils, (as was tried in many cases,) nor was there any authority in my oracle, Davy's 'Agricultural Chemistry,' nor in any other work which I had read, for supposing *vegetable* acid to be present in any soil. Though Davy adds to the supposition of the presence of the "salt of iron," "or any acid matter," it is clear from the whole context that he had in view the possible and extremely rare presence of a *mineral* acid (as the sulphuric,) and not *vegetable* acid, which my views required, and my proofs were afterwards brought to maintain. Sulphuric acid is sometimes found in certain clays, and in combination with iron is also in peat soils; but these facts have no application to ordinary soils of any country. Of course, this absence of authority would, to most inquirers, have seemed fatal to the position of an acid principle being *generally* present in the soils of Virginia, and in great quantity and power of injurious action. This was, indeed, a great obstacle opposed to the establishment of my newly-formed opinion; but it was not yielded to as insuperable. Diffident as I then was of any such views of my own, and holding the dicta of Davy as the highest authority, and even his omission of any position as evidence that it was untrue, or unknown, still I was not daunted, and supposed it possible that the soils of this country might vary essentially in composition in this respect, from those of England; or *barely possible* that even the great chemical philosopher might not have observed the presence of vegetable acid in the comparatively few cases of its existence in English soils. The later observations of subsequent years added much to my evidences of the existence of acid in soils; and still later and scientific investigations of chemists have served to establish that there *is* an acid principle in most soils, in the *humic* or *geic acid*. But these discoveries of chemists had not been published in 1817, (if indeed known to any) nor had my own observations reached to all the proofs which I afterwards (in 1832) published in the first edition (in book form) of the 'Essay on Calcareous Manures,' and which were still in advance of the publication of the now generally received opinions of the geic or humic acid. It must therefore, be confessed, that if I reached a correct conclusion, it was not on sufficiently established premises, and known chemical facts. However, reached it was, whether by right or by wrong reasoning; and however little supported by direct proof or authority, I was almost sure, in advance of any known experiment, first, that the cause of the unproductiveness and unfitness for being enriched of most of our lands, was the presence of acid—and secondly, and consequently, that the application of lime, or calcareous earth, would, by taking up and destroying the poisonous principle, leave the soil free to receive and to profit by enriching manures.

But even if this theoretical position had been demonstrated, still it might furnish no *profitable* practical remedy. For admitting that the application

of calcareous matters would relieve the soil of its great evil, and make it capable of receiving subsequent improvement, yet after being so relieved, the land, I supposed, would be still as poor as before, and would require all the manure, labor and time necessary to enrich any very poor soil; and these might be so expensive, that the improvement of the land would cost more than it would afterwards be worth. These considerations served to lessen my estimation of the practical utility of the theoretical truth, and to make my earliest applications of the theory to practice hesitating, and very limited in extent.

Having settled that calcareous matter was the medicine to be applied to the diseased or illy constituted soil, I was luckily at no loss to find the materials. In some of the many ravines which passed through my land, and on sundry parts of the river bank, were exposed some portions of the beds of fossil shells which underlie nearly all the eastern parts of Virginia and several other southern states; the deposite which then had obtained in this region, though improperly, and still retains the name of *marl*. I began operations in February 1818, at one of the spots most accessible to a cart. The overlying earth was thrown off, and a few feet in width of the marl exposed, in which a pit was sunk to the depth of but three or four feet. When night stopped the digging and throwing out of the marl, the slowly oozing water filled the pit; and as no proper plan of draining had been adopted, the first shallow pit was abandoned, and another opened. In this laborious and wasteful manner there was as much marl obtained as I was then willing to apply. It served to give a covering of 125 to 200 bushels per acre, to $2\frac{1}{2}$ acres of new-ground. The wood on the land had been cut down three years before, and suffered to lie and rot until cleared up for cultivation in 1818. Though poor ridge land, and of what I deemed of the most acid class of soils, still the previous treatment had given to it so much decomposed vegetable matter, that its product would necessarily be made the best which such a soil was capable of bringing. And because of the superabundance of food for plants then ready to act, this was not a good subject to show the earliest and greatest benefit of neutralizing the acid. However—notwithstanding this circumstance, and the small amount and poverty of the marl, (which contained but one-third of calcareous matter,) the improvement produced was greater and more speedy in showing than I had dared to hope for. When the plants were but a few inches high, and before I had expected to see the slightest improvement, (indeed none had been expected to show in the first year,) the superiority of the marled corn was manifest, and which continued to increase as the growth advanced. My high gratification can only be appreciated by a schemer and projector; but such a one can well imagine my feelings and sympathize in my triumph. The increase of the first crop, corn, I stated by guess, in reporting the experiment, to be fully 40 per cent., and that of the wheat which succeeded was much greater. Subsequent measurements of other products of experiments induced me to believe that I had under-rated the amount of increase in this first application. [This experiment is the first stated, and at length, at page 72 of 'Essay on Calcareous Manures,' 3d edition. Throughout this republished article, the references to the pages of the 'Essay on Calcareous Manures, will be changed from the previous to the present edition.]

Great as had been the labor of this application, and small as its increased product, (comparing both with later operations,) the results served completely to sustain my theoretical views, and also showed the remedy for the general evil to be far more quick, and more profitable, than I had counted on. Another person would probably have despised this small

increase to the acre, if supposing the effect to be but temporary; and this all would have inferred, whether judging by comparison with all other manures known in practice, or even if by the authority of books. For the best informed of the old writers, (even Lord Kames, for example,) while claiming for the effects of marl great durability, still consider that at some period, say 20 or 100 years, the effects are to cease. But my views were not limited within any practical experience, or authority, but by my own theory of the action; and that theory taught me to infer that the benefit gained would never be lost, and that under proper cultivation, the increase of product would still more increase, instead of being lessened in the course of time. In thus fully confiding in the permanency of the improvement, I was at once convinced of the operation being both cheap and profitable. All doubt and hesitation were thrown aside, and I determined to increase my labors in marling to the utmost extent of my views. Still the want of spare labor, and the established routine of farm operations which occupied all the force, retarded my operations so much, that no more than 12 more acres (for the next year's crop) were marled in that year.

It forms an essential part of the character of an enthusiastic and successful projector, and especially an agricultural projector, to be as anxious to inform others as to profit himself. Of course I tried to bestow upon and share my lights with all my neighbors and other farmers whom my then secluded life permitted me to meet. This disposition also caused my earliest attempt at writing for even so small a portion of the public as constituted a little agricultural society of which I had induced the establishment in my neighborhood. To show my earliest opinions and statements on this subject, I will here quote the material part of a communication made to that society, and which was written in October of the year of my first experiment in 1818. I copy the extract just as it then stood, and with all its defects of form and of substance. I then shrunk in fear from the greater publicity which the press would have afforded, and had not the remotest anticipation that my first effort, then made, would lead me to the extent of intercourse since established and maintained with the public, both by writing and printing.

"We should be induced to infer from the remarks of those writers who have treated on the improvement of land, that a soil artificially enriched is equally valuable with one which would produce the same amount of crop from its natural fertility; and that a soil originally good, but impoverished by injudicious cultivation, is no better than if it never had been rich. If this conclusion be just (and the contrary has not been even hinted by them) it is in direct contradiction to the opinion of many intelligent practical farmers, with whom my own observations concur, in pronouncing that soils naturally rich, (although completely worn out,) will sooner recover by rest—can be enriched with less manure—and will longer resist the effects of the severest course of cropping, than soils of as good apparent texture and constitution, and in similar situations, but poor before they were brought into cultivation. Should the latter opinion be correct, it is of the utmost importance that the subject should be investigated; as the only conclusion that can be drawn from it is, that such land must have some secret defect in its constitution, some principle adverse to improvement; and until this is discovered and corrected, it is an almost hopeless undertaking to make a barren country permanently fertile, by means of animal and vegetable manure.

"That *inclosing** has but little effect in improving land naturally barren,

* The non-grazing system of Taylor.

is sufficiently proved by poor wood-land. This has had the benefit of inclosing for perhaps thousands of years, and is yet miserably poor. It may be said that leaves are not to be compared in value to grass or weeds; but surely leaves ought to improve as much in a thousand years, as grass or weeds in twenty. Besides, it is well known, that leaves taken from this very land, and applied elsewhere, have produced much benefit; and the advocates of inclosing must agree with me in ascribing to this cause the *natural* fertility of the most valuable land.

"As to manuring, there are but few farmers who have not, like me, experienced complete disappointment in endeavoring to improve land so little favored by nature. In the usual method of summer manuring, by movable cow-pens, the most negligent farmers give the heaviest covering, by suffering their pens to remain stationary sometimes six or eight weeks. I have known the surface in this manner to be covered an inch thick with the richest of manures, and yet, after going through the same course of crops and grazing with the adjoining unmanured land for six years, it could not be distinguished." * * * * * * * * * *

"If any one principle should be always found in one kind of soil, and as invariably absent in the other, we might reasonably infer that *that* was the cause of fertility or barrenness. Judging from my very limited observations, it appears evident that *calcareous earth* constitutes a part of every soil rich in its natural state, and that whenever a soil is entirely or nearly deficient, it never can become rich of itself, and if made so by heavy doses of dung, will soon relapse into its former sterility.

"Let us observe how facts coincide with this opinion. The lower part of Virginia is generally poor; narrow stripes along the rivers and smaller water courses are nearly all the high lands that are valuable, and in this class, exclusively, shells are seen so frequently, and in such abundance, that it seems highly probable that they are universally present, but so finely divided as not to be visible. When we know the change produced by calcareous earth in the color and texture of soil, and in a field of an hundred acres, all of the same dark-colored mellow soil, shells may be seen in only a few detached spots, yet we cannot but attribute the same effects to the same cause, and allow calcareous matter to be present in every part.

"The durable fertility of land which contains shells in abundance is so wonderful, that I should not dare to describe it, were not the facts supported by the best authority. The calcareous matter for ages has been collecting and fixing in the soil such an immense supply of vegetable matter, that near two centuries of almost continual exhaustion have not materially injured its value. I have seen fields on York, James, and Nansemond rivers, now extremely productive, which are said to have been under cultivation for thirty and forty years, without any aid worthy mentioning, from rest or manure.

"The same cause operates on low lands, formed by alluvion, and situated on streams accustomed to overflow. Such land is, with very few exceptions, of the first quality; and it is made so by the calcareous matter which the currents must necessarily convey from the strata of marl through which they pass; and which being intimately mixed with sand, clay, and vegetable matter, is sufficient to form the finest and deepest soil. All the rich low grounds which I have had an opportunity of observing, have marl on some of the streams which fall into them, and I have not heard of any on those few which are poor. Not a solitary instance of shells being found in poor land of any description has come to my knowledge.

"If these premises are correct, no other conclusion can be drawn from them but that a proportion of calcareous earth gives to soil a capacity for

improvement which it has not without; and it also follows, that by an application of shell-marl, the worst land would be enabled to digest and retain that food, which has hitherto been of little or no advantage." * * *

"The property of fixing manures is not more important in marl, than that of destroying acids. The unproductiveness of our lands arises not so much from the absence of food as the presence of poison. We are so much accustomed to see a luxuriant and rapid growth of pines cover land on which no crop can thrive, that we cannot readily see the impropriety of calling such a soil absolutely barren.

"From the circumstance of this soil being so congenial to the growth of pine and sorrel, (both of which are acid plants,) it seems probable that it abounds in acidity, or acid combinations, which, (although destructive to all valuable crops,) are their food while living, and product when dead. The most common forest trees are furnishing the earth with poison as liberally as food, while it depends entirely on the presence of the antidote, whether one or the other takes effect. I have observed a very luxuriant growth of sorrel on land too poor to support vegetables of any kind, from green pine brush having been buried to stop gullies; and it is well known how much land on which pines have rotted is infested with this pernicious plant. Marl will immediately neutralize the acid, and this noxious principle being removed, the land will then for the first time yield according to its actual capacity. Sorrel will no longer be troublesome; and, by a very heavy covering, I have known a spot rendered incapable of producing it, although the adjoining land was thickly set to the edge. Pines do not thrive on shelly land, whether fertile or exhausted. To this cause I attribute the great and immediate benefit I derived from marl on new-ground. The acid produced by the pine leaves is destroyed, and the soil is capable of supporting much heavier crops, without being (as yet) at all richer than it was."—*Communication to Prince George Agricultural Society.*

Before proceeding to state later experiments, and general practice and results, it will be necessary to recur to some other connected branches of the subject. The reader will pardon the apparent digression.

So well established and general has the opinion now become that this *marl* is a manure, and a most valuable one, that it may seem strange that I should have only arrived at such an opinion indirectly, by the train of reasoning indicated above. There were hundreds of persons who afterwards said, "Oh! *I* never doubted that marl was a good manure;" but not one of whom had been induced to try its operation. But passing by these *postponing* believers, and all others who confessedly never attached any value to this great deposite, it may require explanation why I had not learned its value from English works which treat so extensively on marl, even though I had then had access to but few of them. It was precisely because I *had* read attentively some of the English accounts of marl that I was *deterred* from using *our marl*, which agreed with it (apparently) in nothing but name. Struck with the importance attached to marl in England, I had earnestly desired to find it, and had searched for it in vain, years before the early beginning of my farming. The name induced a close examination of what was called marl here; but the "soapy feel," the absence of grit, the crumbling and melting of lumps in water, &c., which were the most distinguishing characteristics of the marl of the English writers, were in vain looked for in our shell beds—of which the earth was generally sandy, never "soapy," and of which the lumps were often of almost stony hardness, and if not, at least showed nothing of the melting disposition of the English marls. I had before this found, however, in the American edition of the 'Edinburgh Encyclopædia,' more modern

and correct views of marl, and had thereby learned to prize *calcareous matter* in general as an ingredient of soil, whether natural or artificial. But still, even admitting that the shelly portion of our marl would slowly decompose, and gradually furnish some manure to the soil, still it seemed that there was little prospect of its operating as the English marl, of such very different texture and qualities. I then supposed that the shells which had resisted decomposition, even where exposed on the surface of the beds, for centuries, would be as slow to dissolve, and to act as manure if laid upon the fields. Still, notwithstanding these grounds of objection, the general idea of the value of calcareous manures would have induced me earlier to try fossil shells, but for being *deterred* therefrom by the only actual facts then known of the use. When speaking of my thought of trying marl to my friend Mr. Cocke, he told me that it was not worth the trouble; that he (attracted merely by the name,) had made several small applications, in 1803, on soils of different kinds, and that he had found almost no visible benefit; and he had attached so little importance to the trial, that he had never thought to mention it, until induced by my remark. This communication was enough to check my then slight disposition to try marl. The old experiments of Mr. Cocke, as well as some much older, and, like his, considered worthless by the makers and almost forgotten, are stated at page 70 of this edition of 'Essay on Calcareous Manures.'

As soon as I was satisfied that I had found in marl a remedy for the general and fixed disease of our poor lands, it became very desirable to know the strength of different beds, and of the different parts of the same bed. The rules of Davy for determining the proportion of carbonate of lime were easy to apply; and having provided myself with the necessary tests and other means, I was soon enabled to analyze the specimens with ease and accuracy. This was a delightful and profitable direction of my very small amount of chemical acquirements, and served to stimulate to further study. The amount of knowledge was indeed very small—and is still so with all later acquirements added. But little as I had been enabled to learn of chemistry, the possession led me to adopt my views of the constitution of soils, and enabled me to double the product, and to much more than double the clear profit and pecuniary value of my land, in the course of a few years thereafter.

Though my own doubts as to the propriety and profit of marling had been removed by my first experiments, it was not so with my neighbors. Small applications were indeed made by two of them only, in the next year after my first trial. But either because the land had been kept too much exhausted of its vegetable matter by grazing as well as by cropping, or because the experimenters could not think of the operation of the manure as different from that of dung, or for both these reasons, it is certain that they were not encouraged by the results to persevere. They stopped marling with their first trial, until several years after, when both recommenced, then fully convinced of the benefit, and were afterwards among the largest and most successful marlers. One of these persons was the late Edward Marks, of Old Town, and the other my old friend Thomas Cocke—who, though he had led me to find the disease, could not be speedily convinced of its true nature, or of the value of the remedy. As late indeed as 1822, when he walked with me to an enormous excavation which I was then making in carrying out marl, he said to me, "In future time, if marling shall then have been abandoned as unprofitable, this place will probably be known by the name of '*Ruffin's Folly.*'" For some years, my marling was a subject for ridicule with some of my neighbors; and this was renewed, when in after-time the great

damage caused by improper applications began to be seen, and which will be described in due order.

Having had in view from the beginning the true action of marl, and fully believing that its good effects would be permanent, and even increasing with time, under a proper system of tillage, I was no more discouraged by what some deemed small profits, than I was annoyed by the incredulity and ridicule of other persons. Almost all the farms in the neighborhood, except mine, were regularly and closely grazed when not under a crop, and of course they had not stored up in the soil much either of inert vegetable matter, or its acid product. Mine had not been grazed since 1814, and had been rested two years in every four; and the poorest land three years in four. And though, in truth, no increased production had been obtained by this lenient treatment, inasmuch as the increase of acid counterbalanced the increase of vegetable food, still, when marl was applied, the acid was immediately destroyed, and the food left free to act. The effect of marling was generally shown most plainly on the first crop of corn, and the limits could be easily traced by the deep green color of the plants before they were five inches high; and the increased product of the first crop on acid soils rarely fell under 50 per cent., was most generally 100, and has been known to be 200 per cent. But even such increase was not satisfactory to many persons, until the action of marl came to be better understood, and the permanency of the effects were credited. In five or six years after my commencement, there were few, if any of those of my neighbors, who had marl visible on their lands, who had not begun to apply it. And though it has been injudiciously as well as insufficiently applied since, and not one-fourth of the full benefit obtained, still the general improvement and increased products of the marl farms of Prince George have been very great. The existence of marl too, which was known at first but on a few farms in my own neighborhood, has been since discovered in many and remote parts of the county; and wherever accessible it is valued and used. The like observations will now apply to most of the other counties of lower Virginia. Wherever the effects of marling could be seen for a few years, the early incredulity not only disappeared, but most persons were even too ready to believe in marl possessing virtues to which it has no claim. Thus, ignorant or careless of its true mode of operation, they crop the marled lands more severely than before; and if they are not thereby soon reduced as low as their former state of sterility, they are made to approach it as nearly as possible, and at a sacrifice of nine-tenths of the profit from marling which a more lenient and judicious system of cultivation would have insured.

In 1819, the second year of my operations, my marling was increased to 62 acres, but most of it at too thin a rate. In 1820, only 25 acres, though at 600 heaped bushels or even more to the acre. Up to this time I had done as most other persons have, that is, attempted to marl "at leisure times," and without making it a regular employment for a certain additional force, or reducing the amount of cultivation, or of other operations on the farm. No person will ever marl to much advantage who does not avoid this error; and this year's labors showed the necessity of an alteration. The next year, two horses and carts, with the necessary drivers and pit-men, were appropriated to marling at all times when weather permitted, except during harvest, thrashing, and wheat-sowing times. Viewing marling too as the most profitable operation, except the saving of a crop already made, it was made a fixed rule of the farm that marling was to be interrupted for nothing else. My corn shift for that year was reduced in size one half—so that one half could be marled while the other was under cultivation. By

these means, I marled 80 acres this year, 1821, (and that much too heavily,) and had all the lessened corn-field on marled land. The product of the half was equal to what the whole had brought before, and I was enabled thereafter to have every field marled over in advance of its next cultivation. In 1822, the land marled was 93 acres, 100 in 1823, and 80 in 1824, which served to cover nearly all of the then cleared land requiring marling. The next three years' marling amounted respectively to 50 acres, 24 acres, and 27 acres, being principally upon land subsequently cleared and brought into cultivation. Since then, there has been no marling on the farm, except on wood-land, not yet cleared, and on small spots formerly omitted, and of which no account was taken. With the exception of such spots, (and some such still remain, because of their inconvenient position,) all the land which was not naturally calcareous, or too wet or too steep for carting on, had been marled by 1827; and none has required any additional dose, though some of the thinnest covered places had been re-marled long before that time, so as to bring them to a proper constitution.

In 1824, I first observed, (and had never before suspected such effect,) the injury caused by having marled acid soil too heavily. To show my first impressions, I will copy the words of my farm journal, written on the very day on which the discovery was fully made.

"June 13th, 1824. Observed a new and alarming disease in a large proportion of my corn; and, what makes the matter much worse, the evil is certainly caused by marling. The disease seems to have commenced when the corn was from 6 to 10 inches high, and to have stopped its growth. Its general color is a pale sickly green, and the leaves appear so thin as to be almost transparent: next they become streaked with rusty red, and then begin to die at the upper ends. Several pulled up, showed no defect, or injury from insects, among the roots. All the land marled from pits Nos. 7 and 9 (both yellow) from 1820 to 1822, is so much diseased as to promise not more than half a crop. The corn is twice as large as on the spaces left for experiment without marl, yet looks much worse; though three weeks ago its superiority in color and vigor was even more than in size. With but few exceptions, the land *newly* marled from the same pits, and the old marling from Nos. 1 and 8, (both blue,) as well as that not marled, are free from this disease. The parts most affected are those which were driest and poorest, and of course were least covered with vegetable matter. Yet though the corn on this old marling is generally so bad, it is yet evident that the land is more benefited by the manure than at first: flourishing stalks of corn, 18 to 24 inches high, are seen frequently within a few feet of those most hurt by this disease."

Subsequently, when the whole extent of injury could be seen, the following remarks were written in the journal, at the date below.

"October 15th. The damage caused by marl to this crop I suppose to be about one third of what the land would otherwise have made, judging from the present and former measurements of the same land, where experiments were made.

"Nearly all the heavy marling in Finnies, (at 800 bushels,) about 20 acres,* suffered by it; the poorest and lightest most injured, here and in Court-House field. The few rich spots escaped, as did most of the piece plastered (on the heavy marling) in 1820. The marks of this experiment were destroyed, and the superiority was not so regular as to enable me to trace the outlines of the gypseous earth—but an acre of corn might be taken which certainly was plastered, better than any other acre in the old

* See Exp. 10, p. 83, Essay on Cal. Man.

land. This at least proves that *gypsum* contained [if any] in the marl has not caused the disease. The poor land, lightly marled in 1819, showed but little of the disease, and none was found in the piece not marled, nor in any marled since the last crop [or now first cultivated since being marled.]

"In Court-House field the injury was confined to 19 acres, the poorest part of the field, which was in corn in 1821,* marled and fallowed, 1822, and in wheat 1823, corn 1824. The remainder of the old land, which had not been cropped so severely, and was covered as heavy with *blue marl*, brought a fine crop, quite free from the disease. The new ground was mostly marled very heavy (800 bushels of 45 per cent.)† and this and all my former clearings, (some marled equally heavy,) were also quite free. These facts satisfy me that it was not the quality, but the over quantity of marl which has caused the evil; and that the land which has escaped, owes its safety to its containing more vegetable matter. I forgot to state that on some of the lightest spots of South Field the wheat was much injured, though blue marl was used there.

"If I had followed my own advice to others, "to put no more marl at first than would but little more than neutralize the soil, and repeat the dressing afterwards," this evil would not have fallen on me. The present loss is not much; but it makes me expect the same on all similar land, marled as heavily. I shall endeavor to avoid it, by giving vegetable matter to the soil; either by manuring, or by allowing one or two more years of grass in the first term of the rotation. *Why* the quantity of marl applied should do harm in *any* case, is more than I can tell; but I draw this consolation from the discovery—if a certain quantity, (say 500 bushels per acre,) is too much for present use of the soil, it proves that it will combine with more vegetable matter, and fix more fertility in the soil, than I had supposed. That the second crop should be injured, and not the first, is owing to the unbroken state of the shells at first, and, by their being reduced, twice as much calcareous matter is in action after a few years."

Thus it will be seen, from these entries made at the time, that I took a correct view of this great and unlooked-for evil, and was by no means discouraged, or induced to lessen my efforts in marling. But in all after operations on poor land, the quantity was lessened from 500 and 600 bushels, (and even more of the poorest marl,) to about 300 bushels. With this alteration, the operation was continued with as much zeal as before; and also at a later time on another farm (Shellbanks) purchased afterwards, and where I marled upwards of 400 acres.

When this injury was first discovered, about 250 acres of very similar land had been marled so heavily that the like mischief was to be looked for in the next crop, and thenceforward, if not guarded against. For a more full account of this disease, and my opinions thereon, I must refer to what has been before published.‡ It is sufficient here to say that by pursuing the means there advised—in allowing more rest from grain crops, furnishing vegetable matter to the land, in its natural cover of weeds, in clover and farm-yard manure so far as the limited supply sufficed—that no very great loss was subsequently suffered, except in the field where the disease was first discovered, and which was marled in 1819. This field was too remote and inconveniently situated, to be manured from the barn-yard; and from that and other causes, (including the failure of the first seeding of clover,) that field only still shows injury from marling in the present crop (1839;)

* Exp. 11, p. 86.
† Exp. 1 to 4, pp. 72 to 77.
‡ Essay on Calcareous Manures, *ante*.

so much diminished however, that its general average product this year is fully twice as much as the land could have brought before being marled.

The results of many particular experiments made during the progress of marling this farm were stated in the 'Essay on Calcareous Manures,' and the general benefits and improved products were described in a later publication.* It is not necessary here to repeat these statements. But as this article may come under the notice of some readers who have not access to the others, the general results, as produced in the whole period of twenty-two years, from the earliest experiment to the last product, will be here very concisely and generally stated.

The many and extensive old galled parts of sloping land, wherever dressed with marl, and even without the further help of barn-yard manure, are now nearly all *skinned over* by a newly formed soil; and though such soil is still both poor and thin, and may yet long remain so, the *whole* of its present productive power is due to marling; as such galled land was before naked, entirely barren, and irreclaimable by other manures. Where much or rich putrescent matter has been also applied to galls, with or after marl, both rich and durable soil has been formed, though at great cost.

The more level parts of the old and greatly exhausted fields, and the newly cleared wood-land, (both kinds being naturally poor, thin, and acid soils,) are the only lands which have enjoyed any thing like the full beneficial effects of marling. These have been increased in product from 5 and 10 bushels of corn per acre (which may be considered the usual minimum and maximum rates,) to at least 20, and in some cases to 30 bushels, even without the aid of barn-yard manure. Where putrescent manures have been also applied, they have raised the products much higher; and these manures are now as durable and as profitable as formerly they were fleeting and profitless in effect.

The before poor and light soil which formed the greater part of the old arable lands, and which was not above three inches in depth, (and scarcely two inches when in its natural forest state,) is now seven inches or more, and requires three-horse ploughs to break it to proper depth, where the one-horse ploughs formerly would frequently reach and bring up the barren subsoil.

The fertilizing operation of marl has increased with time, even where the effects were also the most speedy, and most profitable on the first crop after the application.

The soil, which before was totally unable to support red clover, is now (except on the most sandy spots) well adapted to the growth, and capable, according to the grade of fertility, of receiving the great benefit which is offered by that most valuable of improving crops.

And generally—notwithstanding all the many and great errors committed in my marling, (for want of experience,) and of still worse general farm management—and though a considerable proportion of the old land was either but little or not at all fit to be improved by marling—and though the land added since by new clearings was all very poor, and worthless for its natural producing power—still the general annual grain products of the farm have been increased from three to four-fold, and the net profit of cultivation and the intrinsic value of the land have been increased in a still greater proportion.

* See p. 112, vol. vii. of Farmers' Register.

Addendum, 1842.

The following table of crops, with the annexed remarks and notes, will perhaps be more satisfactory than the preceding statements of general results, besides serving to bring the report down to the present time.

It is proper to premise, that after 1827 I ceased to keep a regular farm journal, and neglected even to preserve accounts of the amount of crops. Ill health and other circumstances had caused me several years before that time to withdraw much of my personal attention from my farming. In 1830, my residence was permanently removed from the farm, and thereafter my superintendence was more and more withdrawn, until it ceased entirely at the end of 1838. Hence the blanks which will be seen in this part of the table. At the close of 1838, my eldest son became the part owner and occupant, and since has been sole director of the farm. Though it was then placed in charge of a new beginner, who had every thing to learn of farming, the management has since been much improved, and consequently also the condition and production of the farm, as shown by the table.

The quantities and other facts, stated below, are taken from careful memoranda noted at the times of the occurrences, and are precise wherever presented as such, according to the best lights possessed by the cultivator. But the volume of my former journal, which embraced the transactions of 1824 to 1827 inclusive, has been lost; and for want of recent reference to it, there may be some inaccuracy in the *dates only* of operations within that time, as well as in the next few succeeding years.

TABLE OF CROPS ON COGGINS POINT FARM.

Year.	Acres marled.	Acres in wheat.	Product in bushels.	Average per acre.	Acres in corn.	Product in bushels.	Average per acre.	Acres in cotton.	Bales of cotton.	Acres in oats.	Bushels of oats.	Acres in roots, vines, &c.
1813		145	810	$5\frac{35}{145}$	125	2250	18					
1814		110	550	5	163	1340	$8\frac{30}{163}$					
1815		78	520	$6\frac{52}{78}$	136	1955	$14\frac{51}{136}$					
1816		104	896	$8\frac{64}{104}$	144	2300	16					
1817		79	595	$7\frac{42}{79}$	188	2050	$10\frac{170}{188}$					
1818	f 15	63	450	$7\frac{9}{63}$	a160	2670*	$16\frac{110}{160}$					
1819	62	132	1015	$7\frac{91}{132}$	a137	2000*	$14\frac{82}{137}$					
1820	25	119	1020	$8\frac{68}{119}$	a164	2780*	17					
1821	80	160	1049	$6\frac{89}{167}$	a 77	1775§	23					
1822	93	154	1627	$10\frac{87}{154}$	a114	2250*	$19\frac{34}{114}$					
1823	100	139	1475	$10\frac{85}{139}$	158	3000*	19					
1824	80	194	1850	$9\frac{134}{194}$	156	3405*	$21\frac{45}{156}$					
1825	50	195	1452	$7\frac{87}{195}$	70	1254	$17\frac{64}{70}$	48				
1826	24	170	1390	$8\frac{3}{17}$	138	2275*	$16\frac{67}{138}$	70				
1827	§§27	151	1366	$9\frac{77}{151}$	104	1665*	16	76	37‖			
1828	0	153	936	$6\frac{18}{153}$	112	1750	$15\frac{70}{112}$	$90\frac{1}{2}$	55			
1829	0	134	908	$6\frac{104}{134}$	133	2300	$17\frac{40}{133}$	96				
1830	50	-	-	-	-	-	-	$50\frac{1}{2}$	33			
1831	0											
1832	0	-	-	-	126	2830	$22\frac{58}{126}$					
1836	10	-	394e	-	-	4415						
1837	0	-	2056	-	-	2620						
1838	0	-	2117	-	-	2070†						
1839	2	167	1252†	$7\frac{1}{2}$†	190	4500	$23\frac{13}{19}$	-	d30	600		
1840	c12	228	1942	$8\frac{1}{2}$	143	3540	$24\frac{12}{143}$	-	50	1000		5e
1841	c32	212	2475	$11\frac{1}{2}$	146	3800	$25\frac{3}{4}$	-	10	200		10e
1842	30	250	3377	$13\frac{1}{2}$	155	3500b	$22\frac{9}{15}$b	-	50	1000		10e

Explanatory remarks on the land and its management.

Quantity of land for cultivation (exclusive of waste parts,) at first, 472 acres; increased by new clearings to 602 by 1826; to 652 in 1832; and no more in 1842 though 30 more acres have since been cleared and tilled, because as much in 1836 converted to a permanent pasture. All the new land added by clearing was poor, and very few acres of it would have produced more than 10 bushels of corn, or 5 of wheat (without the marling) after the 3 or 4 first crops. Of course the new land added served to reduce instead of increasing the general average product per acre.

Rotation at first of three-shifts, viz.: 1 corn, 2 wheat on the richer half, 3 at rest, and after 1814 not grazed. This changed gradually to 4 shifts (by 1823) of 1 corn, 2 wheat, 3 and 4 at rest. 1820 began to fallow for wheat, in part and only in some years. In 1826 or 1827 began to sow the wheat fields generally in clover, and about 1835, to fallow a part (say one-fourth to one-third) of each clover field for wheat the year preceding the crop of corn. This changed in 1840 to a five-shift rotation, one-fifth of the arable land being in corn, two-fifths in wheat (and oats) and two-fifths in clover, or other green or manuring crops.

The crops of wheat for first six years (1813 to 1818) raised on the richer parts of each shift, making about one-half the land only; the other half being then much too poor to be sown. As these poorest parts were marled, all were sown in wheat, in their turn. Therefore, the earlier average products of wheat per acre as stated, were for the richest half of the land, while since 1822 the average is for the worst as well as the best land of each shift.

Grazing the clover fields commenced partially about 1830, and increased since. Latterly about 20 head of cattle and 100 of hogs on the clover during the grazing season.

The crops of hay, corn-fodder, &c., being all consumed on the farm, their products have not been estimated.

Notes on particular crops, &c.

a 1818 to '22 inclusive, 27 acres of rich embanked marsh in corn every year, which served to increase these crops, and their average—which land sunk too low after 1823 for corn, and has since been under the tide.

f In 1818, the first marling.

1828, oats on 17 acres.

1829 to 1830, a succession of bad seasons for wheat, or of crops—made much worse (as I afterwards believed,) by the land having been so long kept from being grazed and trodden by cattle.

* These crops not actually measured, but amounts otherwise estimated. All other quantities measured, unless stated otherwise.

§ The richer half of the shift only cultivated in corn this year (1821.)

§§ Marling nearly extended over all the cleared arable land requiring it, and injurious where too thick.

From 1825 to 1830 inclusive, the richest land of the farm kept under cotton, which served greatly to lessen the general products, and still more the average product per acre of the wheat crops, during that time.

|| 13,027 lbs. of cotton, net weight as sold, or 170 lbs. to the acre.

e 1836, the wheat crop nearly destroyed by rust, as was general through eastern Virginia.

† Corn crop of 1838 and wheat crop of 1839 very much lessened by the ravages of the chinch-bug.

c, c, On 26 of these acres the marling was a second application.

d The crops of oats being consumed on the farm, were never measured, but the quantities estimated by the land sown, at 20 bushels to the acre.

e The root crops, (turnips and beets,) and pumpkins and cymblins, occupied part of the most highly enriched land—all consumed on the farm, and products not estimated.

b The crop of corn of 1842 stated upon supposition, it not being half gathered when this article was prepared.

NOTE VII.

(*From the Farmers' Register of Oct.* 1835.)

INQUIRY INTO THE CAUSES OF THE FORMATION OF PRAIRIES, AND OF THE PECULIAR CONSTITUTION OF SOIL WHICH FAVORS OR PREVENTS THE DESTRUCTION OF THE GROWTH OF FORESTS.

Introductory remarks.

The views which will be presented in the following pages are in part founded on others which were maintained, and are considered as established in the 'Essay on Calcareous Manures'—as, for example, the doctrine of the existence and causes of acid and still more of neutral soils—the chemical power of calcareous earth to combine with and to fix vegetable or other putrescent matter in soils—and that a certain proportion of lime, in some form, is essential to every productive soil, and without which ingredient the land would be barren, and incapable of being enriched. As the repetition here of the whole train of argument by which those doctrines were sustained would be both unnecessary and improper, it may be permitted merely to refer to the work named for these positions, as premises established, and either known, or accessible to every one who may feel interest in the further extension and consideration of the same general subject, which is here designed.

The necessity of making frequent reference to a previous and avowed work, and also the having elsewhere stated the general purport of this, will prohibit the writer from presenting this continuation anonymously; which otherwise would have been preferable, both on account of the writer's connexion with the journal in which this will appear, and because the subfect is one which will derive no support from its origin, being a matter of general argument resting on facts and authorities within the reach of every reader. But as these circumstances made it necessary that the piece should not be anonymous, for convenience the ordinary form of a communication to the Farmers' Register has been adopted. Whatever of opposition to editorial usage may appear in these respects, it is hoped will be sufficiently accounted for, and held excused by the existing circumstances. However confident the writer may be of the main positions which he will aim to establish in the following pages, he is sensible that he is venturing upon a new field of investigation, which is as yet unexplored—and indeed almost untouched, except by those who have paid no attention to the problem to be solved, or of others who, with better lights of science, have fallen into gross and manifest errors and mistakes. Under such circumstances, he cannot expect to avoid being misled in many particulars; and he will be gratified at having such errors corrected, and the subject fully and properly treated by any other person possessing better means for receiving information, and pursuing this interesting subject of inquiry.

General and erroneous opinions respecting the growth or absence of trees on land in a state of nature.

There exists a wide-spread and strongly marked difference between the lands of different regions of the globe, in their being covered, or not, with trees, before being subjected to cultivation. But striking and strongly contrasted as are these different aspects of parts of the earth's surface, and much as each kind, when a novel scene, has drawn forth expressions of wonder and admiration from travellers, the causes have not been sought —

indeed have scarcely attracted any attention. Yet, even if considered as a mere matter of curiosity, not likely to bring to light any thing of practical use, there is scarcely one of Nature's riddles which would seem better calculated to interest philosophical, and especially agricultural investigators. These very different kinds of garb which are worn by different regions of the earth, extend over vast spaces, and of course are accompanied with many remarkable changes both of climate and soil. It follows that there are not many persons who have been accustomed to more than one of these conditions of the face of the earth; and those who have been, were not of the class the best qualified for investigating the subject. The first European settlers of North America were, by the contrast to their native lands, the more forcibly impressed by the magnificent forests of which there seemed to be no end, and no change, except from the greater abundance of one luxuriant and gigantic growth to that of others. But this universal cover of the land, so different from any thing before known, was merely described with admiration by Europeans. No cause was sought for, or thought wanting; and they remained content with most erroneously attributing the luxuriant growth of trees to the fertility of the soil, and the want of the labors of tillage.*

The children of the early settlers grew up among forests, and they and their children, judging from all they saw, learned to consider that almost all soils, rich or poor, naturally would be covered by trees; and while falling into this error, they at least got rid of that of their forefathers, in connecting the idea of a luxuriant forest growth with great fertility. When the spread of population finally brought the latter descendants to the borders of the Mississippi, and the great prairies of the west first opened to their astonished view, this change was as great as unaccountable, and yet the cause as little sought, as that of the universal forest state had been by the first emigrants from Europe. But ignorant wonder soon ceases, and leads

* The words of the founder of Virginia, Capt. John Smith, show that the noble growth of trees which he and the other first European visiters found, gave them a very high and certainly mistaken opinion of the general fertility of Lower Virginia. "Within [the capes of Virginia,] is a countrey that may have the prerogative over the most pleasant places knowne, for large and pleasant navigable rivers; heaven and earth never agreed better to frame a place for man's habitation, were it fully manured and inhabited by industrious people. Here are mountains, hils, plaines, valleyes, rivers, and brookes, all running most pleasantly into a faire bay, compassed, but for the mouth, with fruitful and delightsome land."——"The vesture of the earth in most places doth manifestly proue the nature of the soyl to be lusty and very rich. The colour of the earth we found in diverse places resembleth *bole Armoniac, terra a sigillata*, and *Lemnia*, fuller's earth, marle, and divers other such appearances. But generally for the most part it is a blacke sandy mould, and in some places a fat slimy clay, and in other places a very barren gravell. But the best ground is knowne by the vesture it beareth, as by the greatnesse of trees, or abundance of weeds, &c."——"Virginia doth afford many excellent vegetables, and living creatures, yet grasse there is little or none, but what groweth in low marishes: for all the countrey is overgrowne with trees, whose droppings continually turneth their grasse to weeds, by reason of the rancknesse of the ground, which would soone be amended by good husbandry. The wood that is most common is oke and walnut, many of their okes are so tall and straight that they will beare two foote and a halfe square of good timber for 20 yards long."——(*Second Booke of the Trve Travels, Adventvres, and Observations of Captaine Iohn Smith, &c. London*, 1629.) Captain Smith was altogether unskilled in agriculture, and it may be presumed that when he spoke of the need of such rich land being "fully manured," as well as inhabited, he meant nothing more than that it should be properly cultivated—of which, manuring was deemed a general and necessary part. But this accidental (and according to his views, erroneous) expression, was much nearer the truth than the opinion of fertility being proved by the "greatnesse of trees;" for much the greater part of the land bearing the largest and most magnificent growth of oaks, pines, and other common trees, was in truth poor then, and will ever remain so, without the application of calcareous matter.

to no profitable search for causes, or for truth. The children of the first settlers of the west have grown up among prairies; and when another century shall have passed, and our frontier settlements shall have reached the base of the Rocky Mountains, it may begin to be believed there, that the forest state is rarely known to nature, and is only produced by the labors and care of man. So the Bedouin Arab thinks the world is made of naked sand—and the Shetlander's world is of wet peat.

Of course these general remarks apply to those who are acquainted only with some one region of the world, and who have not been informed of others by books, any more than by travel. Among the more learned, there has been no lack of causes assigned for these opposite appearances; but they are such as to show a strange disregard of all the requisites of sound reasoning, and of accurate investigation. Any reason that was first advanced, however insufficient, however absurd, seems to have been readily admitted, and to have passed current from one traveller, or writer, to another. Thus, to the annual fires alone has been attributed the destruction of trees, and the formation of the great prairies of the west; and this cause has been deemed sufficient by both the learned and the ignorant. The objection to it is, that all the Atlantic slope was burned over as often as the west, before the settlement of the country, and in the former (at least east of the mountains) not one acre of prairie had been produced.

Philosophical writers have maintained supposed causes of the destruction of the forests which formerly covered England, which are very plausible when considered alone. But precisely similar causes have been operating long and generally in this country, and our forests not only do not decay and die, but continue to defy every agent of injury, except the thorough use of the axe and plough. Even where long continued tillage has the most effectually eradicated the natural and original forest growth, if the impoverished land is merely let alone for thirty years, it will (in most cases) be better covered with a new growth of trees, than the utmost care could raise in England. Examples of the facts and reasoning referred to are presented in the following passage from Davy. "In instances where successive generations of vegetables have grown upon a soil, unless part of their produce has been carried off by man, or consumed by animals, the vegetable matter increases in such a proportion, that the soil approaches to a peat in its nature; and if in a situation where it can receive water from a higher district, it becomes spongy, and permeated with that fluid, and is gradually rendered incapable of supporting the nobler classes of vegetables.

"Many peat-mosses seem to have been formed by the destruction of forests, in consequence of the imprudent use of the hatchet by the early cultivators of the country in which they exist: when the trees are felled in the out-skirts of the wood, those in the interior are exposed to the influence of the winds; and having been accustomed to shelter, become unhealthy, and die in their new situation, and their leaves and branches, gradually decomposing, produce a stratum of vegetable matter. In many of the great bogs in Ireland and Scotland, the larger trees that are found in the out-skirts of them bear the marks of having been felled. In the interior, few entire trees are found; and the cause is, probably, that they fell by gradual decay; and that the fermentation and decomposition of the vegetable matter was most rapid where it was in the greatest quantity."—[*Lec.* 4.] In Virginia no one forest tree has been known to die, or even to decline, from being exposed in the manner above described as so fatal: and such effects being produced in England would only prove that the soil was unfavorable to trees, and their life therefore feeble and sickly, and ready to yield to any new and considerable cause of injury.

The entire absence of trees for 900 miles across the Pampas between Buenos Ayres and the Andes, has been still more absurdly attributed to the winds (called *pamperos*) which often sweep across those wide plains with such violence, that no trees could withstand their power. I have seen in our forests where a hurricane had uprooted or broken off every tree of size in its course. But no wind could destroy the young and flexible underwood; and if such winds swept the same track every year, or every month, they would not prevent it being thickly covered with young sapling trees.

The downs in England, which have not been tilled for hundreds of years, and are only valuable for sheep pasture, show no rising growth of trees. This is not held strange there, but would be supposed sufficiently accounted for by the poverty of the soil, and the (supposed) impossibility of young trees growing, even if planted on open pasture land, without any care, and where they were always exposed to the attacks of live stock. But in Virginia, no degree of poverty, no exposure to grazing, will prevent untilled land growing up in wood. Annual fires, grazing animals, and poverty, wetness or sandiness of soil, all may prevent the growth of trees, as alleged in different countries; but all these are but secondary causes which would have little or no effect, without the more powerful operation of some other and primary cause. *This cause will be found in the peculiar constitution of the soil;* and I will proceed to state my reasons for believing that the cause of the different conditions of land as to being naturally covered with trees, or not so in general is merely *the deficiency of lime in the soil, or its abundance*—the former state being friendly to forest growth, and the latter being as unfriendly. Or—in terms so general as to cover all the exceptions which will hereafter be admitted to the foregoing position—it may be stated, that the formation of prairies, &c., is caused by *the existence of such circumstances as favor the growth of grass in a far greater degree than the growth of trees*—and of all such circumstances, the abundance of calcareous matter in the soil is the most efficient.

In addressing readers residing in, or otherwise well acquainted with the Atlantic states, it is unnecessary to adduce facts to prove the general and strong disposition of the soil to produce trees, in vigor and luxuriance—to resist the labors of man for their destruction—and to return to the state of forest whenever tillage is intermitted. No untilled land will long remain naked, or in grass; and even under a regular rotation of crops, the labor of grubbing to destroy young trees is continually required on most lands, and particularly on those originally of inferior quality. Our poorest lands in lower Virginia, are generally covered with young pines in four or five years after being left without tillage, and their after-growth is as rapid and heavy as European timber growers would expect on the best lands, and with every care bestowed for that end. But it is not only to pines, (though that is the most striking case,) that this applies. In the higher and stiffer lands, where pines are rare, the springing of other young trees shows the same general tendency of the soil. If this tendency can be said to be feeble any where in lower Virginia (and it may be presumed that the same state of things exists in all the Atlantic states,) it is on the few naturally rich soils on the rivers, some of which are the only lands naturally calcareous in the country, and all of which derived their natural fertility and permanent value from possessing lime in some form as an ingredient. In the 'Essay on Calcareous Manures' proofs have been exhibited of this supposed quality of such lands,* and therefore they will not be repeated here. It has also been maintaned

* Part 1., chapter vii.—On neutral soils.

in the same work, and the proofs exhibited at length, that in Virginia and the Atlantic states generally there are few soils containing naturally any portion whatever of *carbonate of lime*—and all the vast region which is so peculiarly constituted in being destitute of this ingredient, is precisely that which so strongly favors the growth of trees.

Over all this great extent of country, we may suppose that the aboriginal inhabitants sent fires every year to aid their hunting. Indeed it would have been scarcely possible to avoid it, when almost the whole country was under one great forest, and the entire surface covered with dry leaves. For more than a century after the settlement of the present race of civilized inhabitants, fires passed over the wood-land almost every spring—caused either by the carelessness or design of hunters, or by the farmers to forward the growth of grass for their cattle. It required legal prohibitions, added to the general extension of tillage, and the great damage of burning fences, &c., to put a stop to this practice of burning the woods. Even in these latter times we hear of fires of tremendous fury sweeping hundreds of square miles in Maine, destroying timber, and every combustible matter on the few small farms in this yet wild region. Yet no where below the mountains, nor in any poor region, has the wood growth been destroyed—nor has an acre of prairie been thus formed, whether on land rich or poor. This is enough to prove that no violence or frequency of fires can destroy and keep down the growth of trees, unless aided by some other and more efficient agent.

The most general cause of the absence of trees.

The next position that will be assumed is, that most of the prairies, pampas, steppes and downs, which are bare of wood, though never tilled, are highly calcareous, and therefore unfriendly to the growth of trees.

The proofs necessary to maintain such wide ground, directly and absolutely, would require more of time, and labor of investigation, than the labors and life of any one individual would suffice for; therefore the facts that will be offered are considered only as specimens of the thousands which the world could furnish, and to be taken as fair samples of all, only while they remain uncontradicted by other opposing facts. No traveller having (to my knowledge) sought to learn or to report any particular information as to the constitution of such soils, or having attached any importance to the presence or absence of calcareous ingredients, I have only been able to gather indirectly from their observations the scattered testimony which will be adduced. Unfortunately no traveller has been a scientific agriculturist; and though many have been mineralogists, geologists, or chemists, they have given no attention to the constitution of the soils over which they passed, nor did any seem to consider that the composition of the soil had any bearing on its strange external features, which were the theme of their admiration. Dr. Clarke, distinguished as he deservedly was as a man of science, has told as little of the nature of the soil of the Russian steppes, as most of the least uninformed of the observers of our prairies.

Proofs—derived from the general description of prairies, pampas, steppes, &c.

Before entering more upon particulars, in addressing readers who are generally (like the writer) accustomed only to soils favorable to trees, it is proper to describe generally the features of the great regions which are bare of such growth, and which, under the different names of *prairies*, *barrens*, and *savannas* in North America, *pampas* in South America, and *steppes* in

Russia and Tartary, form a very large portion of those parts of the globe. All of these, with various grades of fertility, and many points of difference in other respects, agree in being, or having been at some time when in a state of nature, bare of trees, or nearly so, and in being clothed with grass of greater or less luxuriance.

The word "prairie" was first applied by the French colonists, and means, in their language, a *meadow*. The name therefore plainly enough designated all land covered only with grass. The name of "barrens," so strangely applied in Kentucky to very rich lands, of this kind, was owing to the resemblance of the dry grass on these lands to the broom grass which covers and grows luxuriantly on the naturally poor soils of lower Virginia, when left out of cultivation. This resemblance caused the surveyors who were sent to lay off the Virginia military lands, to reject these as barren soil, and the term then so erroneously applied to an extensive region, has still continued to be used, and even has been extended to similar lands elsewhere.

It will be most sure and satisfactory to use the language of the writers who have seen and described these regions, rather than to attempt a more general and condensed description, at the risk of changing the purport of their expressions. None of these writers, nor any that I have been able to consult, give any direct and positive testimony derived from analysis, as to the soil being supplied, or not, with calcareous ingredients. It is only from incidental observations of the nature of the rocky subsoil, the kinds of grass, &c., that any information of this kind has been indirectly gathered. All that can be said is, that such testimony, so far as it goes, is in favor of the calcareous composition of such soils generally. Such expressions as most strongly (though indirectly) support my views of the constitution of prairie soils, or show a resemblance of one of these regions to some other better known, will be put in italics.

The first extracts will be from the *Views of Louisiana*, by H. M. Breckenridge, a writer intimately acquainted with the western country, and who describes what he had travelled over and seen. The Louisiana of which this work treats includes not only the state as now bounded, but all the vast region lying west of the Mississippi, formerly held under that general name by the French and Spanish governments.

"This extensive portion of North America, has usually been described from the inconsiderable part which is occupied by the settlements, as though it were confined to the immediate borders of the Mississippi, as Egypt is to those of the Nile. By some, it is represented in general description as a low, flat region, abounding in swamps and subject to inundation; which is the same thing as if the Netherlands should furnish a description for all the rest of Europe. Others speak of Louisiana as one vast forest of wilderness:

"Missouri marches through the world of woods;"

which is far from being the case, for excepting on the banks of this river, and that not more than one-half its course, the country through which it passes is deplorably deficient in woods. If, then, we are to describe Louisiana, not from a small district, important because already the seat of population, but from the appearance of the whole, combined in a general view, we should say, that it is an extensive region of open plains and meadows, *interspersed with bare untillable hills*, and with the exception of some fertile tracts in the vicinity of the great rivers by which it is traversed, resembling the grassy steppes of Tartary or the Saharas of Africa, but without the numerous morasses and dull uniformity of the one, or the dreary sterility of the other. The fertile tracts are chiefly to be found in the

narrow valleys of the great rivers Missouri, Mississippi, Arkansas, Red river, and some of their principal tributaries; the two largest bodies of fertile soil are the delta of the Mississippi, which is much interspersed with lakes, marshes, and sunken lands, that will require ages to reclaim, and the territory of the Missouri, as limited by the boundaries lately agreed on with the Indians, which bears a strong resemblance to the West Tennessee in some of its features."—pp. 66, 67.

"A remarkable feature in this western side of the great valley [of the Mississippi] is its deficiency of wood, while the opposite (with the exception of some parts on the north side of the Ohio, where the woods have been burnt,) is a close and deep forest. The woods continue for a short distance up the Mississippi before they disappear, and the grassy plains begin. The banks of the Missouri are clothed with luxuriant forest trees for three or four hundred miles, after which they gradually become bare, and the trees diminish in size; at first we find thin groves of the kind of poplar called cotton wood, but of a diminutive growth, intermixed with willows; next the same tree, reduced to half its height, and resembling an orchard tree; after this a thin border of shrubbery is almost the only ornament of the margin of the river. The same thing may be said of the Arkansas and Red river.

"Taking the distance to the mountains to be about nine hundred miles, of the first two hundred, the larger proportion on the Missouri and its waters is well adapted to agricultural settlements, its soil and conveniences are equal if not superior to those of Tennessee or Illinois; this tract will include the greater part of the White and Osage rivers, the lower Missouri, and for at least one hundred and fifty miles north of this last river. The proportion of wood gradually lessens to the west, and still more to the north, with the addition that the lands become of an inferior quality. For the next three hundred miles, the country will scarcely admit of compact settlements of any great extent; the wooded parts form trifling exceptions to its general surface, and are never met with but on the margin of the rivers. We may safely lay it down, that after the first two hundred miles, no trees are found on the uplands, save stinted pines or cedars; the rest of the country consists of open plains of vast magnitude, stretching beyond the boundary of the eye, and chequered by numerous waving ridges, which enable the traveller to see his long wearisome journey of several days before him. Yet, it does not seem to me, that the soil of this tract is any where absolutely unproductive; it is uniformly covered with herbage, though not long and luxuriant like that of the plants nearer the centre of the valley; it is short and close, but more nutritious to the wild herds, than the coarse grass of the common prairie. This tract has not the dreary barrenness described by Johnson in his Tour to the Hebrides; the green carpet which covers, and the beautiful shrubberies which adorn it, afford relief to the eye. But again, it is very doubtful whether trees could be cultivated; for I observed that *the trees which by accident are permitted to grow, are but dwarfs;* the oak for instance, is not larger than an orchard tree, the plumb is nothing more than a shrub, in some places not exceeding a currant bush. There are, however, scattered over the immense waste, a number of spots which greatly surpass in beauty any thing I have ever seen to the east of the Mississippi. But there are others, again, barren in the extreme, producing nothing in the best soil but hyssop and the prickly pear."—pp. 69, 71.

"Thus it appears, that with the exception of a belt of one hundred and fifty, or two hundred miles in width, at most, stretching from the Missouri, in a line parallel with the course of the Mississippi, across the Arkansas and Red river to the Sabine, about twice the territory of New York, but not a

tenth part of the western section of the valley, the province of Louisiana is little better than a barren waste, and that the eastern side will always contain a much greater population."—p. 72.

"This western region, it is certain, can never become agricultural; but it is in many respects highly favorable for the multiplication of flocks and herds. Those delightful spots, where the beauty and variety of the landscape might challenge the fancy of the poet, invite to the pastoral life. How admirably adapted to the interesting little animal, the sheep, are those clean smooth meadows, of a surface so infinitely varied by hill and dale, covered with a short sweet grass, intermixed with thousands of the most beautiful flowers, undeformed by a single weed.

"I confess that, to me, nature never wore an aspect so lovely as on the lonely plains of the west. From their dry and unsheltered surface, no damp and unwholesome vapors rise to lessen the elasticity of the air, or dim the brilliant blue of the heavens. So transparent is the atmosphere, that a slight smoke can be discerned at the distance of many miles, which curiously exercises the caution and sagacity of the fearful savage, ever on the watch to destroy, or to avoid destruction. And then, that sublime immensity which surrounds us; the sea in motion is a sublime object, but not to be compared to the varied scenes which here present themselves, and over which the body, as well as the imagination, is free to expatiate. The beams of the sun appeared to me to have less fierceness, or perhaps this might be owing to the cool breezes which continually fan the air, bringing upon their wings the odors of millions of flowers. The mind appears to receive a proportionate elevation, when we are thus lifted up so much higher than the centre of the valley. There was to me something like the fables of fairy land, in passing over a country where for hundreds of miles I saw no inhabitants but the buffalo, deer, the elk, and antelope: I have called it the paradise of hunters, for to them it is indeed a paradise. There are, however, some important drawbacks on the advantages of this country, even considered as a pastoral district. To the north of the Missouri, rains are extremely rare, but when they are set in, pour down in torrents, while to the south their place is chiefly supplied by heavy dews. In the dry season, which is from the month of June until the latter end of September, at a distance from the great rivers, *water is every where exceedingly scarce.* The buffalo at this time leaves the plain and seeks the rivers, and the Indians in their excursions to any considerable distance are obliged to shape their courses by some known pond, and to carry besides a quantity of water in bladders. It is possible, that wells might be sunk, but it is certain, that at this season *one may travel for days without finding a drop of water;* one may frequently pass the beds of large rivers which have disappeared in the sands, but after rains, or on the melting of the snows, impassable torrents are seen to fill their channels, and to roll down in turbid and frightful floods."—pp. 73, 75.

"The tract of country north of the Missouri is less hilly than that on the south, but there is much greater proportion of prairie. It has a waving surface, varied by those dividing ridges of streams, which in Kentucky are called *knobs.* These prairies, it is well known, are caused by repeated and desolating fires, and the soil is extremely fertile.

"The plains of Indiana and Illinois have been mostly produced by the same cause. They are very different from the savannas on the sea board, and the immense plains of the Upper Missouri. In the prairies of Indiana, I have been assured that the woods in places have been known to recede, and in others to increase, within the recollection of the old inhabitants. In moist places, the woods are still standing, the fire meeting there with obstruc-

tion. Trees, if planted in these prairies, would doubtless grow. In the islands, preserved by accidental causes, the progress of the fire can be traced; the first burning would only scorch the outer bark of the tree; this would render it more susceptible to the next, and the third would completely kill. I have seen in places, at present completely prairie, pieces of burnt trees, proving that the prairie had been caused by fire. The grass is usually very luxuriant, which is not the case in the plains of the Missouri. There may doubtless be spots where the proportion of salts, or other bodies, may be such, as to favor the growth of grass only.

"Such woods as remain are fine, but the quantity of adjoining prairie is usually too great. There are large tracts, however, admirably suited for settlements: a thousand acres or more of wood land, surrounded by as much of prairie. It is generally well watered with fine streams, and also interspersed with lakes. There is an extensive strip of land along this side of the Missouri, of nearly thirty miles in width, and about one hundred and fifty in length, altogether woods, and of excellent soil. An old gentleman, who has seen Kentucky a wilderness, informed me that the appearance of this tract is similar, with the exception of its not being covered with cane, and a forest so dark and heavy. The "Forks of the Missouri" (such is the name given to the northern angle formed by the two great rivers) daily increases in reputation, and is settling faster than any part of the territory.

"The Missouri bottoms, alternately appearing on one side or other of the river, we have already seen, are very fine for three hundred miles up, generally covered with heavy timber; the greatest part of which is cotton wood of enormous size. The bottoms are usually about two miles in width, and entirely free from inundation. The bottoms of the Mississippi are equally extensive and rich, but not so well wooded. They are in fact a continued succession of the most beautiful prairies or meadows. The tract called *Les Mamelles*, from the circumstance of several mounds, bearing the appearance of art, projecting from the bluff some distance into the plain, may be worth describing as a specimen. It is about three miles from St. Charles; I visited it last summer. To those who have never seen any of these prairies, it is very difficult to convey any just idea of them. Perhaps the comparison to the smooth green sea is the best. Ascending the mounds, I was elevated about one hundred feet above the plain; I had a view of an immense plain below, and a distant prospect of hills. Every sense was delighted, and every faculty awakened. After gazing for an hour, I still continued to experience an unsatiated delight, in contemplating the rich and magnificent scene. To the right, the Missouri is concealed by a wood of no great width, extending to the Mississippi, the distance of ten miles. Before me, I could mark the course of the latter river, its banks without even a fringe of wood; on the other side, the hills of the Illinois, *faced with limestone*, in bold masses of various hues, and the summits crowned with trees; pursuing these hills to the north, we see, at the distance of twenty miles, where the Illinois separates them, in his course to the Mississippi. To the left, we behold the ocean of prairie, with islets at intervals. The whole extent perfectly level, covered with long waving grass, and at every moment changing color, from the shadows cast by the passing clouds. In some places there stands a solitary tree of cotton wood or walnut, of enormous size, but from the distance diminished to a shrub. A hundred thousand acres of the finest land are under the eye at once, and yet, on all this space, there is but one little cultivated spot to be seen."—pp. 204,206.

"——— Nothing else was visible—not a deer, not a tree—all was prairie —a wide unbroken sea of green—where hollow succeeded hollow, and the

long grass waved on the hills with a heavy surf-like motion, until at last it was blended with the hazy atmosphere, which met the horizon. The power of sight was shut out by nothing; it had its full scope, and we gazed around until our eyes ached with the very vastness of the view that lay before them. There was a degree of pain, of loneliness, in the scene. A tree would have been a companion, a friend. It would have taken away the very desolation which hung round us, and would have thrown an air of sociability over the face of nature; but there were none. The annual fires which sweep over the whole face of the country during the autumn of every year, effectually destroy every thing of the kind. There will be no forest as long as the Indians possess these regions; for every year, when the season of hunting arrives, they set fire to the long dry grass. Once fairly on its errand, the destructive messenger speeds onward, licking up every blade and every bush; until some strip of timber, whose tall trees protect the shrubbery, by the dampness which they diffuse beneath, or some stream, stops it in its desolating path.

"The object of burning the grass is to drive the deer and elk that are roving over the broad extent of the prairies, into the small groves of timber scattered over the surface. Once enclosed within these thickets, they fall an easy prey to the hunters."—*Irving's Indian Sketches*, 1835.

The next extracts are from an article in Silliman's Journal, by W. W. McGuire, on the prairies of Alabama.

"In speaking of the prairies, the rock formation claims particular attention. It is *uniformly found below the prairie soil*, at various depths, ranging from ten to fifteen feet, and it sometimes projects above the ground. This rock is generally known by the name of *rotten limestone;* when removed for several feet on the top, and exposed to the action of the atmosphere for some time, it assumes a beautiful white color. In its soft state it is easily quarried, and blocks of almost any dimensions can be procured. It has been dressed by planes and other instruments, and used in building chimneys, some of which have stood twelve or fifteen years without injury or decay. A summer's seasoning is requisite to fit it for building. This rock has been penetrated by boring to depths varying from one hundred to five hundred and fifty feet; after the first six or seven feet, it is of a bluish or gray color, but still soft except in a few instances, where flint strata of a foot thick or more have been met with. On perforating the rock, a full supply of good water is always obtained, which uniformly flows over the top. I have heard of no constant running stream of water over this rock, except one in Pickens county, near the lower line. The superincumbent earth is for a few feet composed principally of stiff clay, of whitish color; then comes the mould of soil, which is very black—in wet weather it is extremely miry and stiff, and in dry, very hard and compact.

"*Shells, such as the oyster, muscle, periwinkle, and some other kinds, are found in great quantities throughout almost all the prairies of Alabama and Mississippi;* the first named being the most numerous, mixed in every proportion with the others. The oyster shells are perfectly similar to those now obtained from the oyster banks on the shores of the Atlantic. The largest beds of shells in the open prairies seem to occupy rather elevated, but not the highest places. They have probably been removed from the more elevated situations by torrents of rain. It may be that the lowest places never contained any shells; or if they did, as vegetable matter accumulates in greater quantities in low situations, they may have been thus covered. In some instances I believe they have been found in such places, several feet below the surface. They are not found in very large quantities in the timbered prairies; and indeed, so far as I have observed, where-

ever the shells are numerous, vegetation is not so luxuriant as where there is a proper admixture of the decomposed or decomposing shells and vegetable matter.

"These shells and other decomposing materials appear to have given a peculiar character to the prairie soil, which causes it to adhere so strongly to the legs of horses and to the wheels of carriages as to remain several days in travelling, unless washed or beaten off. Yet, when well broken up. at the proper season, and regularly ploughed, it remains quite mellow, producing corn and cotton equal to the best alluvial bottoms, with, so far as it has been tried, increased fertility; although, from the compact nature of the rock beneath, and the tenacity with which it retains moisture, crops are injured sometimes by rains, but seldom by drought.

"There being no opening or fissures, except above the rock, by which to convey the water directly to the channel of creeks and rivers, there are consequently *no reservoirs to contain supplies for fountains and springs.* In the winter and spring seasons the streams overflow and the land is literally submerged. In the summer and autumn *neither springs nor wells are to be found*, except below the rock; yet, notwithstanding this scarcity of water, there is seldom a lack of moisture for the purpose of vegetation. And at times when the drought is such as to produce fissures two or three inches wide, and as many feet deep, *the earth will be found quite moist at the depth of two or three inches.*

"There are open prairies of every size, from one hundred to one thousand or twelve hundred acres, mixed and interspersed in every form and mode with timbered land of all kinds; some producing only black-jack and post oak, not exceeding fifteen or twenty feet in height; others again covered with the most majestic oak, poplar, elm, hickory, walnut, pacaun, hackberry, grape-vine and cane, equal in size and beauty, I understand, to similar kinds in the Mississippi alluvions.

"The extent of this country may not be unimportant. I am informed that traces of prairie soil may be seen in Georgia, perhaps as far east as Milledgeville. It is indeed said to exist in North Carolina; but of this I have not evidence such as to warrant the assertion. That it stretches nearly five hundred miles eastward from the vicinity of the Mississippi on the west almost to Milledgeville, there is no doubt; and if it extends, as is said to be the fact, to North Carolina, it reaches four hundred or five hundred miles farther, being perhaps nine hundred or one thousand miles long, and from forty to sixty in breadth."

In addition to the foregoing extracts, several communications to the Farmers' Register, (which are before its readers,) confirm these statements, and (independent of the aid of chemical analysis, which will be referred to hereafter,) show that the prairie soils of Alabama generally are intermixed with calcareous earth, and universally underlaid with that substance in a much more pure form, yet soft enough to be penetrated by roots.* The letter of N. D. Smith, Esq., in the last number gives a like account of the underlying stratum of the prairies of Arkansas. Such is also the account of Mr. Featherstonhaugh in his geological report of that region—and in addition to the calcareous character of the underlying soft rock, he speaks (though not in very definite terms) of the black rich soil above, as being substantially calcareous."† Another similar fact in a remote locality, has recently been published. A tract of prairie land in the northwest part of Pennsylvania,

* See Farm. Reg. pp. 276, 277, 367, of vol. i.—and pp. 637, 716, 717, vol. ii, and p. 140, Essay on Calcareoous Manures.

† See extract from the report at page 147, vol. iii. Farm. Reg.

lies on calcareous earth, so pure as to be converted, by being burnt, to lime of the best quality. This earth reaches to within a foot of the surface.*

The next extracts present sufficient ground for considering the steppes and prairies as belonging to the same class.

"In all parts of the river [Don] above Kasankaia, *it seems to flow over a bed of chalk;* and its banks, gently swelling upwards from the water, rise like the South Downs of Sussex; *often disclosing the chalk, of which they consist.* Farther down, and near the water's edge, low copses of wood almost always accompany its course; but they diminish as it draws nearer to Tscherchaskoy, the inhabitants of which town derive all their wood from the Volga.

"As soon as we left Kasankaia, we entered the *steppes* in good earnest, with a view to traverse their whole extent to Tscherchaskoy. These are not cultivated; yet, bleak and desolate as their appearance during winter must be, they have in summer the aspect of a wild continued meadow. The herbage rises as high as the knee, full of flowers, and exhibiting a most interesting collection of plants. No one collects or cuts this herbage. The soil, though neglected, is very fine. We passed some oaks in the first part of our journey, which had the largest leaves I ever saw."—*Clark's Travels in Russia*, p. 189.

"Leaving this encampment, we continued traversing the *steppes* in a south-westerly direction, and passed a very neat village belonging to a rich Greek, who, to our great surprise, had established a residence in the midst of these desolate plains. As we advanced, we perceived that wherever rivers intersect the *steppes*, there are villages, and plenty of inhabitants. A manuscript map at Tscherchaskoy confirmed the truth of this observation. No maps have been hitherto published in Europe which give an accurate notion of the country. A stranger crossing the Cossack territory, might suppose himself in a desert, and yet be in the midst of villages. The road, it is true, does not often disclose them; but frequently, when we were crossing a river, and believed ourselves in the midst of the most uninhabited country, which might be compared to a boundless meadow, we beheld villages to the right and left of us, concealed, by the depth of the banks of the river, below the level of the plain; not a single house or church of which would have been otherwise discerned."— p. 198.

"From Acenovkaia, we continued our route over *steppes* apparently destitute of any habitation. Dromedaries were feeding, as if sole tenants of these wide pastures."— p. 199.

Dr. Clarke, though traversing a vast extent of steppes, says very little more of them than is presented in the short quotations above. They give a clear though indirect indication of their chalky formation, and similarity to the *downs* of Sussex in England. Yet the author seems to have attached no importance to these facts, nor does he take any other notice, direct or indirect, of the nature, or chemical composition of the soil. Yet, in addition to his scientific attainments as a chemist and mineralogist, his botanical knowledge, if properly applied, would have thrown much light on this subject. I have no doubt but hereafter the character of soils, as to possessing calcareous matter abundantly, or being destitute of that ingredient, will be determined with certainly by the presence or absence of many different plants. Dr. Clarke gives a catalogue of many of the plants observed in his journey, and of them a few are stated to have been found on the steppes.

* See Farmers' Register, page 169, vol. iii.

These are copied below,* that others who have some knowledge of botany, may be able to state whether these plants are confined to calcareous soils or not. If the author had stated that sheep sorrel was a common growth of the steppes, I would at once admit, from that solitary fact, that the soil must be destitute of calcareous earth. In like manner, if the soil is highly calcareous, some of the plants which he observed there, or which may be found on the prairies, would afford as certain proof of that fact, as the presence of sorrel would of the reverse. These suggestions are thrown out for the consideration of investigators who have the knowledge and opportunities requisite to put them to use. It is a new field for botanists, which promises a sure and valuable harvest.

The next extracts, which are from Tooke's *View of the Russian Empire*, will give more full information of the steppes.

"*Arable land.*—Under this head we must reckon various tracts of land, especially, 1. Those that are kept in constant cultivation and tillage, such as are every where seen in Great and Little Russia, in the provinces bordering on the Baltic, and many others. 2. Such as are only used at times, and left quiet for a great length of time. In some regions, for instance, in Little Russia, about the Don,† &c. where they are looked upon as steppes, which if merely ploughed and then sown, would be productive; in others, for example, in Livonia, Esthonia, and Ingria, where they are rendered fertile by fire, and are called by the countrymen bush-lands.‡ On such parcels of ground, which are either allotted into particular possessions, or without a proper owner, villages might be gradually erected. In uninhabited districts these tracts are most frequent. 3. Those that are proper for agriculture, but lie totally unemployed: they wait only for industrious hands. There are still plenty of these vast tracts where millions of men might find work and profit, especially in fruitful steppes, and in numberless large forests.

"The fertility of all these tracts is very different according to the quality of the soil. In Livonia and Esthonia, from good fields they reap 8, and in successful years from 10 to 12 fold; from indifferent ground about only 3, but from better, at times 16 or even more than 20 fold. The harvests about the Don are commonly 10 fold; but towards Tomsk on the Tshumush, and in the whole region between the Oby and the Tom, many fields afford an increase of 25 to 30 fold,§ and at Krasnoyarsk the failure of a crop was never heard of; of winter corn they reap 8, of barley 12, and of oats 20 fold.‖

"In Little Russia, on the Don, and in many other places, the fields are never manured, only ploughed once, just to turn up the earth, afterwards harrowed, and then sown: more culture, especially dunging, would push the

* "*Centaurea frigida*, northern knap weed—on the steppes." "*Centaurea radiata*, rayed knap weed—on the steppes near Koslof. The sheep feed on it in winter, and it is supposed to give them that gray wool so much valued by the Tartars." "*Crocus sativus*, autumnal meadow-saffron—steppes near Achmetchet." "*Geranium sylvaticum*, wood crane's bill—steppes." "*Silene quadrifida*, four-cleft catch-fly—steppes, near Perecop," "*Sisymbrium Loeselii*, Loesel's hedge-mustard—steppes near Perecop." *Statice trigona*, three-sided lavender—in the steppes, very frequent." "*Vescia pannonica*, Pannonian vetch—steppes. "*Stipa Pennata*—in all the steppes." Many other plants are named in different parts of the work, as found in the region of steppes, but it is not certain that they were always from such soil, and therefore are not added to this list.

† The Don Kozak takes, in whatever part of the steppe he chooses, a piece fit for cultivation, and, bestows his labor upon it as long as he thinks proper or as long as its visible fertility will amply reward his labor.

‡ See Hupel Liefl. and Esthl. vol. ii.

§ Pallas, vol. ii. p. 650 et seq.

‖ Ibid. vol. iii. p. 6.

corn up too luxuriantly or parch it, and so hurt the harvest, as the soil is sufficiently fertile of itself. Of equal goodness is the ground in great part of Siberia; for example, on the Samara, on the Ufa in the country of the Bashkirs, here and there in the Baraba, or the Barabinian steppe, also on the Kama, whence a great quantity of corn is sent to the northern cornless dwelling-places on the Dvina and Petshora. In like manner too in the government of Isetsk the soil generally consists of a black earth, to the depth of an ell, consequently is proper for tillage, for meadow-land, and garden ground. On the Oby near Barnaul, the black earth does not indeed go very deep, *but the marly clay* that lies under it fertilizes it so much* as to make it, in some places, yield plentiful harvests, without manuring, for twenty years successively.† At Krasnoyarsk, the fields will bear no manure whatever, and yet continue fruitful for 10 or 15 years, if only suffered to lie fallow every third year.‡ When the fertility ceases, the boor takes a fresh piece from the steppe. On the Selenga, in the district of Selenghinsk, the fields are hilly, and yet will bear no manure, as it is found on repeated trials to spoil the corn."§

Speaking of the meadow land, the same author says—

"Some steppes produce the best meadow-grass for provender, and yield seed for making artificial meadows; such as the *esparcette*, the alpine hedysarium, *clover*, various kinds of artemisia, pulse, star-flower plants,¶ and fine grasses that will bear any climate."

There was good reason to believe that other plants mentioned as growing on these lands, as clover, vetches, &c. indicated a calcareous soil; but here is one mentioned, which alone is a positive and sufficient proof. *Esparcette*, which is stated as one of the natural grasses of some of the steppes, is the French name of sainfoin—and the fact of its growth, alone, proves, as well as any chemical analysis could, that all the soils bearing it are highly calcareous. Sainfoin not only delights in calcareous soils, but it will scarcely live, and cannot thrive, on any other. It is a valuable grass on chalk soils in England, which would be almost barren under grain tillage; and it has never been raised in Virginia, and indeed will scarcely produce a few feeble and scattering stalks on our best lands. The bald and least productive prairies of our western country would be the proper place for this grass.

"All the meadows may be reduced to these four kinds: 1. Fine productive meads that have a good black, but somewhat moist soil: these yield the greatest crops, of hay; to them belong the luchten [overflowed land.] 2. Dry, whereof the soil is fit for agriculture, and at times is so employed; they commonly yield a short but very nutritious hay. 3. Watery and marshy; these do not produce the best, but give a very serviceable hay in cases of scarcity in parching summers and dry places. 4. Fat steppes, where the grass in some parts grows to the height of a man: they are seldom mown."

"*Steppes.*—This term does not properly denote low and watery places, or morasses, but dry, elevated, extensive, and for the most part uninhabited plains. Some of them being destitute of wood and water, are therefore uninhabitable; others have shrubs growing on them, and are watered by streams, at least have springs or wells, though they are void of inhabitants;

* A dark-gray earth, about a foot deep, beneath which runs a layer of clay, and is held in many places to be fine arable land.

† Pallas, vol. ii. p. 641.

‡ Ibid. vol. iii. p. 6.

§ Ibid. p. 168.

¶ Ibid. vol. ii. p. 75.

yet in these, nomadic people wander about with their herds and flocks, and thus make them, if not their constant, yet their summer residence. In many of them are seen villages. Some occupy a very large space: thus it is calculated that the steppe between Samara and the town of Uralsk* amounts in length to upwards of 700 versts; but, as every twenty or thirty versts we come to a lake or river, the Ural Kozaks traverse them when they fetch their meal from Samara. Probably hereafter several of these steppes, at least in some places, will be cultivated, if they wish to raise forests upon them.

"In regard to the soil an extreme variety prevails, either being very fruitful and proper for agriculture or for meadow-land, or indiscriminately for both. Accordingly in the steppe about the Don, the Kozaks of those parts employ themselves in agriculture, as well as in the breeding of cattle. Some of them furnish excellent pasture by their fine herbage, as the southern tract of the Isetskoi province, and the steppe of the middle horde of the Kirghistzi.† Or the soil is unfruitful: whether it be the sand, the salt, or the stone it contains that is the cause of it. Among these are to be reckoned the sandy steppe on the Irtish near Omsk; in general we find about the mountains up the Irtish pure arid steppes, and therefore no villages. Also the Krasno-ufimskoi, between the rivers Belaia, Kama, and Tchussovaia, towards the Ural-chain, is mostly sandy; and that on the Argoun towards the borders of China, is of a still worse soil, consisting of rocky particles and flint. The whole of the steppe along the river Kushum, towards the town of Uralsk, is described by Prof. Pallas‡ as dry, poor, saline, and unfit for any kind of agriculture, for the breed of cattle, and even for permanent inhabitants; there is not even a solitary shrub to be seen, much less any wood. In general *saline spots are not unfrequent in the steppes;* and here and there we also meet with salt-lakes: however, such districts may invite to camel-pasture."—pp. 81, 83.

"The steppes are *frequently fired* either by the negligence of travellers, or on purpose by the herdsmen, in order to forward the crops of grass; or, it may be, out of malice, as some years since the Kozaks of the Yaik did; when, having risen in rebellion, a small corps of Russian troops advancing against them, they saw themselves all at once almost entirely surrounded by the high grass on fire. Such a catastrophe often occasions great mischief; the flames spread themselves far and wide, put the dwellings of the inhabitants in imminent danger, consume the corn on the ground, and even seize on the forests. Many prohibitions under severe penalties have accordingly been issued against this practice, but they seldon have any effect.§ All the steppes may be considered as a sort of common land."--p. 84.

"The steppe of the Don and the Volga comprises the whole space between the Don, the Volga, and the Kuban, and is a large, very arid steppe, altogether destitute of wood and water; it has few inhabitants, and contains several salt-lakes and salt-plots."——"Within the confines of this steppe lies what is called the Kuman steppe"——"this, it is said, has all the appearance of a dried-up sea: it is a sandy, part clayey salt plain, without trees. Many circumstances render it probable that it might really have been the sea bottom, as the flat shores of the Caspian and Azof Seas, the shallowness of their coasts, the low situation of the steppe, the saline lakes, *and the sea shells*," *&c.—Rees' Cyclopædia.*

Of the extensive Kamyk steppe, it is said, in the same work, that "the soil consists of sand, *marl, and clay, often mixed with sea shells.*"

* Formerly Yaik.
† Pallas, vol. ii. p. 75.
‡ Travels, vol. iii. p. 525.
§ See Pallas, vol. ii. p. 378.

The latter passages include under the general name of steppes, sterile deserts of altogether a different character. In like manner, some great tracts of naked sand in South America are called pampas—and some of what are called prairies, west of the Arkansas territory, are of somewhat similar general character to those described above. These are mentioned here to avoid the appearance of omitting what might be considered as oppposing my positions. But these regions are altogether different from the lands properly called prairies or steppes; and have no more connexion with our subject than if they had been more properly called sandy, stony, or salt deserts.

"*Pampas*, a province in South America, in the vice-royalty of Buenos Ayres, consists of vast plains, which extend from the sea coast on the east, to that great chain which forms the beginning of the Cordilleras of Chili, about 140 leagues west from the city of Buenos Ayres. Towards the south, they stretch about 100 leagues, to a chain proceeding W. N. W. from the Atlantic. The northern boundaries are not distinctly known, but the name of Pampas is chiefly applied to the territory on the south of Buenos Ayres, Cordova, and Mendoza. These vast plains, like the steppes of Russia, having scarcely any elevation, the view, as at sea, is terminated by the horizon. They are only diversified with paths and ditches, which collect the rain waters, and which commonly end in lakes, as there is no declivity; yet there are wide tracts in which *no water is found, nor is that element pure*; and the trees are extremely rare, except a few shrubs round the lakes. Hence this region is only inhabited by a few wandering savages. The soil is generally *a black earth of little depth, and is followed by a kind of coarse chalk, so that it is difficult to form wells, as the water can scarcely pass so tenacious a substance.* The chief pasturage is *clover*, and in the best parts, sometimes so strong as to resist the step of a horse: it is much liked by the cattle, which, when there is water, multiply prodigiously in the pampas."—*Rees' Cycl.*

"On leaving Buenos Ayres, the first region is covered for 180 miles with clover and thistles; the second region (480 miles) produces long grass, without a weed; and the third, reaching to the base of the Cordilleras, is a grove of low trees and shrubs, in which such beautiful order is observed, that one may gallop between them in every direction."——"The climate of the pampas is subject to great differences of temperature, though the gradual changes are very regular. The winter is as cold as an English November. The summer is oppressively hot. *But the whole pampas enjoy an atmosphere as beautiful and salubrious as the most healthy parts of Greece and Italy, without their malaria.*"—*Malte Brun's Geog.*

"The whole plain [nearest] to the foot of the Cordillera, is a loose sandy soil, greatly impregnated with saline matter, which is inimical to vegetation in the natural way. This immense tract is called the Traversia, or the Desert, resembling similar tracts in Africa. *When assisted by irrigation, it is the most fertile soil imaginable.*"—*Malte Brun's Geog. vol.* 3, *p.* 362, (*note.*) *Am. Ed.*

A late traveller from Buenos Ayres to the Andes, Temple, speaks thus of the first and second regions of pampas:

"The country for leagues round is covered with thistles, which at this season are to be seen growing to the prodigious height of eight, and, in some places, ten feet: cattle which go in amongst them to seek a shade from the sun, and to feed upon the grass beneath, are completely concealed. These thistles* form almost the only fuel for the few inhabitants who are scattered

* At certain periods of the year, when the clover withers enormous thistles, ten or twelve feet high, suddenly shoot up, hem in the roads and paths, and form a dense and

over this vast wilderness: not a tree is to be seen, with the exception of a few peach trees, which have been planted in the immediate neighborhood of the huts." * * * * * * *

"We now bade adieu to the region of thistles, through which we travelled for upwards of one hundred miles, and which, on each side of the road, extended as far as the eye could reach. At this season of the year, in consequence of these gigantic weeds being parched by the sun, the country, at a distance, had the appearance of being covered with ripe corn; but the scene was too monotonous to afford any agreeable impression. Madame de Stael, on her journey into Russia, remarks, [of the steppes,] "there is so much *space* that every thing is lost—" "*meme les chateaux, meme la population. On diroit qu'on traverse un pays dont la nation vient de s'en aller.*" Here, on the contrary, the traveller would say that he traverses a country where the nation is *yet to come;* for every thing exists as nature first formed it, unimproved, uncultivated, untouched." * * * *

"After leaving the region of thistles before mentioned, we travelled for about 120 miles through a country of more agreeable aspect, though not a tree as yet appeared to our view, the whole being one vast field of rich pasture. This is the true pampa of South America of which we have of late years read and heard so much in Europe." * * * *

"Innumerable herds of cattle, the progeny, it is said, of six cows and a bull imported rather more than two centuries ago from Spain, range at large over this ever verdant surface of inexhaustible luxuriance. I have been credibly informed that their numbers at the present day bear no proportion to what they were before the devastating havoc of the late civil war; still they appear to a European eye in countless multitudes, and leave the traveller no longer cause to wonder that such fine animals should, at one time, have been slaughtered in *thousands*, merely for their hides." * *

"This noble plain, entirely covered with pasture, extends many hundred miles into the regions of Patagonia, where it is yet unexplored. M. Humboldt calculated its area at 70,000 square leagues. 'This area,' he observes, 'of the pampas of Tucuman, Buenos Ayres, and Patagonia, (they are all united,) is consequently four times as large as the area of all France.'

"No lawn was ever laid down with greater precision by the hand of man, than this vast interminable plain has been by nature. Not a stone is to be seen on its surface."— *Temple's Travels.*

"In the whole of this immense region, there is not a weed to be seen. The coarse grass is its sole produce, and in the summer, when it is high, it is beautiful to see the effect which the wind has in passing over this wild expanse of waving grass: the shades between the brown and yellow are beautiful. The scene is placid beyond description: no habitation or human being is to be seen, unless occasionally the wild and picturesque outline of the gaucho on the horizon, his scarlet poncho or cloak streaming horizontally behind him, his balls flying round his head, and as he bends forward towards his prey, his horse straining every nerve."—*Head's Rough Notes*, &c.

Nature of prairie soils, so far as ascertained by chemical tests.

After I had ascertained the truth of the novel and strange fact that scarcely any soils in Virginia, or of the other Atlantic states, of which I had

impenetrable barrier. Mr. Head remarks: "The sudden growth of these plants is quite astonishing: and though it would be an unusual misfortune in military history, yet it is really possible, that an invading army, unacquainted with this country, might be imprisoned by these thistles, before they had time to escape from them."—*Head's Notes.*

opportunity to examine specimens, contained any calcareous matter (carbonate of lime,*) it became a new subject of surprise to learn from articles which have been published in the Farmers' Register (pp. 276, 277, vol. i.) that many of the prairie lands of Alabama were highly calcareous according to the observations of those who judged merely from appearances. Combining this fact with my own personal experience that old cleared lands, even slightly calcareous, were much more easily kept clear of young bushes, than naturally poor and acid soils—and with what I had read of the nakedness of chalk downs in England—and the general difficulty of rearing trees in calcareous parts of Europe—all served to build up the opinion which I now aim to establish, that the abundance of calcareous earth in prairie soils was the principal, and is a sufficient cause of the absence of trees. Still there had never been an analysis made of any such soil, to my knowledge, and there was no other kind of evidence (however slight) of such quality of any prairie soils, except of a part of Alabama; and reports of the constituent parts of soils, judged solely by the eye, or by the mere close neighborhood of calcareous rocks, I knew from experience, deserved but little credit or respect. In 1834, I first obtained some such proofs from a few specimens of prairie and wood-land soils from Marengo county, Alabama, and one from Mississippi. The prairie soils were all calcareous, containing from 8 to 59 per cent. of carbonate of lime; and these were the first specimens of highly calcareous soils that I had ever examined, except from shelly spots on the banks of our tide-water rivers. The wood-land soils, like our lime-stone and other rich *neutral* soils† contained no *carbonate* of lime. Since then, other specimens have been received and examined from various parts of Alabama—and also the reports of analyses of others, made by Dr. Cooper and Dr. Gibbes of South Carolina, have been received, and have been published in this journal.‡ Most of these soils are highly calcareous. *But also some specimens of prairie soils contain not a particle of carbonate of lime.* This apparent contradiction will be considered hereafter.

It is proper to observe here that I do not extend the term *prairie* to any land bearing trees, unless of new growth, or land known to have formerly been without them. But the distinctness of this term is much impaired by its being now applied in Alabama (and perhaps elsewhere) to soils having the same peculiar texture, appearance, and sensible qualities, though covered with trees. Thus "wooded prairies" are spoken of in the pieces formerly published in this journal, and referred to in this piece.

In addition to new facts of the same kinds, for the convenience of the reader, an abridged statement will here be given of the calcareous ingredients of all the prairie soils which I have formerly examined, or which have been analyzed by other persons, and the results communicated for publication to the Farmers' Register: and also of other neighboring soils, sometimes improperly called "prairie," though covered with growing trees. It is proper to observe, that my own examinations were confined to lime in one form of combination only—the *carbonate*—and that the silicious, aluminous, and vegetable ingredients, when mentioned, were judged of by the senses, and not by accurate chemical tests. My own trials and results will be given first.

Specimens of soils from Marengo county, Alabama, furnished and selected by Richard Cocke, Esq. (Described more fully at page 44 of 'Essay on Calcareous Manures.'

* Essay on Calcareous Manures, p. 34.
† Essay on Calcareous Mnaures, p. 38.
‡ See pages 715, vol. ii, and 272, vol. iii. Farmers' Register.

No. 1. Prairie soil of the most productive kind in Alabama—a black clay, with scarcely any sand, yet so far from being stiff, becomes too light by being tilled. Bears luxuriant crops of corn, oats, and cotton—but the last, after a few years, becomes subject to rust. Contained 8 per cent. of carbonate of lime. All this kind of soil lies on a substratum of "rotten limestone," (specimens of which contained from 72 to 82 per cent. of carbonate of lime) and which rises sometimes to the surface, forming the "bald prairies."

No. 2. Bald prairie soil—"comparatively poor—neither trees nor bushes grow there, and only grass and weeds before cultivation—corn does not grow well—small grain better—cotton crops soon become subject to rust." Contained 59 per cent. of carbonate of lime. The general substratum of rotten limestone in texture and appearance, as well as in chemical character, approaches the chalk of Europe more nearly than any other earth known in the United States.

No. 3. Very rich cane brake land—a kind of prairie of a wetter nature, from the winter rains not running off freely, and the tenacious soil not permitting the superfluous water to sink through—contained 16 per cent.

No. 4. From the valley cane land—very wet through winter, but always dry in summer; after being ditched dry enough, and brings fine cotton, &c. Contained no carbonate of lime.

No. 5. From what is called the best "post oak land," on which trees of that kind stand from two to four feet in diameter—but little underwood, and no cane—nearly as rich as the best cane land. No carbonate of lime.

No. 6. "Palmetto land," having that plant as well as a heavy and luxuriant growth of large trees. A cold and wet soil before being brought into tilth, but afterwards soft and easy to till, and produces corn and cotton finely. The cane on it generally small. Soil from 4 to 10 feet deep. No carbonate of lime.

Selected by Dr. W. J. Dupuy—

No. 7. Soil from the Choctaw Prairie in Mississippi, an extensive body of fertile land. Contained 13 per cent. of carbonate of lime.

Selected and sent by Dr. R. Withers, of Greene county, Alabama—

No. 8. From Kemper county, Miss., part of a "considerable body of similar land, extending into Neshobak and Winston counties. Chocolate colored sandy loam, very friable and easily worked—produces corn and cotton well—growth, hickory, black-jack and some other oaks, principally red oak, interspersed with a few pines." Contained no carbonate of lime.

No. 9. "Prairie soil from near Demopolis, Alabama, taken from the road near the surface. The rock here is within a few inches of the surface, and many small fragments are mixed with the soil. It is a dark calcareous mould—produces corn finely; but there is too much lime for cotton." Contained 60 per cent. of carbonate of lime.

No. 10. Subsoil of the common "open prairie" of Greene county, taken from a foot or more below the surface. "The soil above is dark, and probably less calcareous. The rock is not more than two feet below the surface. Lime was perceptible in this specimen in powder, in detached masses, before being pounded." Contained 50 per cent. of carbonate of lime.

No. 11. "From the southern part of Noxubee county, Miss.—taken 4 inches below the surface, of land cultivated two years. It is a prairie country, but different from ours on this side of the Tombeckbe, in having the elevated parts of it, which hardly amount to hills, covered with hickory trees, interspersed with some black-jacks. Hence it is often called a "hickory barren" country. Between the timbered portions, there are long

savannas, or open prairies, which are very level and rich. This specimen was taken from one of them. It is covered with a very heavy grass coat, very much resembling the gama grass; and some of it I know is of that species. It is at first very difficult to eradicate; but when this is once effected, the soil is as easily ploughed as other prairie soils, and produces corn very finely; say from 50 to 60 bushels to the acre. Cotton however is predisposed to rust at first, and probably will be more so after the undecomposed vegetable matter existing in the primitive soil becomes exhausted. Immediately on the outskirts of the hickory hammocks, where they join the open prairie, the cotton is much more disposed to rust, even the first year, and it is from such a locality that it was selected."

No. 12. "This soil is very loose and friable, and it is generally in such land that I have observed the cotton to rust most. It grows off at first more luxuriantly than in other places, but as the heat of summer comes on, begins to look scorched, sheds its shapes, then the bolls, and leaves, until nothing is left but the dead stalks. These two specimens, Nos. 11 and 12, do not effervesce perceptibly with diluted sulphuric acid, but I presume you will find them strongly impregnated with lime. There is a considerable tract of country of this kind of soil in Mississippi, and the lime-stone rock frequently shows itself near the surface. Detached masses of sand-stone are also frequently seen about the hill-sides and hickory hammocks."

Neither of the last two specimens (Nos. 11, 12,) contained any carbonate of lime. The descriptions have been quoted at length, because the facts are among those that most oppose my argument. A similar deficiency of calcareous earth was found in the four next specimens, which were sent by Capt. John Symington, U. S. A., of St. Louis.

No. 13. From a small prairie in the neighborhood of St. Louis, Missouri. Fertile, but not equal to the best prairie soils. "This is high and rolling, and consequently dry—and never subject to inundation. Specimen taken about 4 inches below the surface, and just below the fibrous grass roots."

No. 14. "From the surface of a ridge of rolling prairie, in Macoupin county, Illinois—high and dry, and never subject to inundation."

No. 15. "From Macoupin county, Illinois. Also high prairie, and never subject to inundation, but quite level, and therefore the rain water does not flow off rapidly enough. Still it cannot be called a wet soil. It is considered rich, and produces well grain of all kinds. Taken 2 feet below the surface."

No. 16. Sent by George Churchill, Esq. Sample of the soil of the "Ridge Prairie," Madison, Illinois—"taken from 4 inches below the surface, where it has never been ploughed, and three-quarters of a mile from the nearest wood-land. Surface dry and rolling."

Neither of the four last specimens contained a particle of carbonate of lime. All were very black (therefore supposed full of vegetable matter) and contained but a very small proportion of finely divided silicious earth. For any practical and useful purpose, this essential ingredient might almost be said to be entirely wanting.

No. 17. Prairie soil from Madison county, Ohio—contained no carbonate of lime.

No. 18. Prairie soil from Pickaway county, Ohio, contained a very small portion only of carbonate of lime. The amount was not ascertained precisely.

The three next, selected and sent by Jas. Deas, Esq., were all taken from different depths below the same field of "unwooded prairie," in Lowndes county, Alabama. The surface soil black.

No. 19. Taken 4½ feet below the surface, where very fertile—stiff clay

of dark olive color when dry, and pounded for trial—very little silicious earth, and that very finely divided. Contained 11 per cent. of carbonate of lime.

No. 20. "At 1½ feet below the surface, where the soil is rather thin" [or poor]—nearly white—contained 84 per cent. of carbonate of lime.

No. 21. At 3 feet below the surface of another place, "also rather thin soil." Color darker than the preceding. Carbonate of lime, 27 per cent.

No. 22. Of the celebrated fertile alluvial soil of Red River, Arkansas, a specimen of 300 grains contained 12 grains of earthy carbonates, of which rather more than one third was found to be *carbonate of magnesia*—the remainder carbonate of lime. So far as I am informed, this is the first known fact of magnesia being found in a notable proportion in any soil in this country. It is hoped that this peculiarity of the Red River land will receive further investigation. The presence of magnesia was indicated by the very slow effervescence of the soil in acid. The separation of the two carbonates was made according to Davy's method, (directed in his "Agricultural Chemistry,") which, however, is not very accurate.

The results of analyses of prairie soils (and some which, though so called, are covered with trees,) made by Drs. Cooper, Nott, and Gibbes, will now be adduced. See the more full report, Farmers' Register, p. 716, vol. ii.

No. 23. Bald prairie on Big Swamp, Lowndes, Alabama. Plantation of Col. James Deas. Carbonate of lime 25 per cent.

No. 24. Slue prairie—same plantation—15 per cent.

No. 25. From plantation of Messrs. Elmore and Taylor, on Pintlala creek, Montgomery, Alabama—open prairie—taken 6 inches below the surface. Carbonate of lime 38 per cent.

No. 26. From same spot, taken 18 inches below the surface. Carbonate of lime 48 per cent.

The balance were very late examinations of Alabama soils made by Dr. R. W. Gibbes, July 1835, and published in the Farmers' Register, vol. vi.

No. 27. Slue prairie, (Col. Elmore's plantation)—6 or 8 inches below the surface—Carbonate of lime 26 per cent.

No. 28. Hammock prairie, carbonate of lime 22 per cent.

No. 29. Open prairie, mahogany colored, *no limestone*, and vegetable matter as much as 38 per cent.

No. 30. Hog-bed prairie, carbonate of lime 8.

No. 31. Post oak prairie, *no limestone*, and vegetable matter 38 per cent. [From the name, it is presumed that this is such wooded land as No. 5, and therefore improperly called prairie land.]

No. 32. Black slue prairie, (Moulton plantation of Dr. J. H. Taylor.) Carbonate of lime 12 per cent.

No. 33. Prairie, (scattering large post oak.) mingled with red clay. Carbonate of lime 6 per cent.—and vegetable matter 32.

No. 34. Open prairie—from a hill or ridge, 18 per cent.

No. 35. White open prairie, (Chisolm's)—from near surface—soil not more than 18 inches deep. Carbonate of lime 42 per cent. Vegetable matter 28.

Formation of prairies, &c. accounted for, and apparent exceptions to the rule explained.

My views of the manner in which prairies are formed will now be submitted.

There are some few trees, as wild or black locust, papaw, and hackberry, which thrive best on soil moderately calcareous, and will scarcely live in soils very deficient in lime. But most forest trees prefer soils having so

little lime, as to be, if not naturally poor, at least unfriendly to the growth of grass. Hence such lands are covered naturally by an unmixed growth of trees, and are almost destitute of grass. Calcareous soils are, on the contrary, favorable to the growth of grass, and unfavorable to the growth of trees, and the more so (other circumstances being alike) in proportion to the excess of lime in the soil. Supposing such a soil to have been so protected as to be covered with trees, the first passage over it of fire, which would be harmless to the more hardy growth of acid soil, would here serve to scorch and damage the trees, feeble and tender, because unnaturally placed. This effect would be the greater because such calcareous woodland would have some growth of rank grass, which, as dry fuel, would add to the violence of the fire, and to its effect. The next winter, the crippled and stinted condition of the trees would prepare them to be still more damaged by the like passage of fire, and its violence would be increased by the greater quantity of dead and dry wood; and the increased growth of grass less obstructed now by shade. Every year these circumstances would serve the more to augment the destructive power of the fires, and to diminish the power of resistance in the still living trees. In the course of time all the trees would be killed, and burnt, and then the seeds and roots after springing in vain many succeeding summers, would finally have to yield to destruction also. The surface is then covered with the growth of grass most suitable to its composition, which growth is luxuriant according to the fertility of the soil. So long as fires sweep every year over such land, the prairies can never be covered with wood; and on the contrary will be extending every year so long as there is wood which the fires can destroy, and land that will yield grass to furnish the fuel for still more extended ravages.

It may well happen also, that a soil not at all calcareous, if bordering on a prairie, would be so exposed to the power of fire, when driven in all its violence by strong winds, that its trees would be damaged, and finally killed, and the land brought likewise to the prairie state. Such land, however, would be making continual efforts to return to its more natural state of wood-land; and whether under young wood, or a meager cover of grass, would, by refusing fuel, serve to check the farther extension of the ravages of fire.

This would be one means of land not calcareous being brought to the prairie state. There are two other means for the formation or extension of prairies on land not calcareous, both of which are probably more often operative. These will now be considered.

It may be inferred that the destruction of trees on calcareous soils is not so much caused by their absolute unkindliness to trees, as by their far greater suitableness for grass, which serves when dry as fuel to burn the trees. Now if any thing other than the presence of calcareous earth will produce an equally rank growth of grass, the same destructive end will be produced, and as completely in time, though perhaps with less facility and quickness. Moisture in the soil will in this manner serve as well as calcareous matter—and if the surface is only dry enough at some time in every year to permit full force to the fire, similar effects must be produced in destroying and keeping down the growth of trees. In this manner are formed the rich alluvial prairies or savannas on the great western rivers, which are covered by floods sometimes, and perfectly dry at others.

Again—a soil may be free from floods, and from all water except from the clouds, and yet without being calcareous, may be so constituted as to attract and retain moisture, with great force, and thus be very favorable to the growth of grass, and consequently to the formation of prairies. This constitution is produced when a soil is formed almost entirely of fine alu-

minous, or argillaceous earth, and decomposed vegetable matter—and this is precisely the composition of every specimen of prairie soil which I have examined, and which was not highly calcareous. Examples of some such soils are presented in the foregoing list. The soils contained very little silicious earth, and that little so fine as only to be made sensible to trial between the teeth. The ordinary mode of separating silicious from aluminous earth, by agitation in water, was quite ineffectual for the purpose. Though no *carbonate* of lime was present, it is certain that the soils were neutral*—that is, that they contained in some other combination enough lime to make fertile and absorbent soils. This, added to the quantity of finely divided vegetable mould, and to the fine clay composing nearly the whole earthy portion, forms a soil that holds water like a sponge, and must be peculiarly favorable to the growth of grass.† This alone will suffice to account for prairies being formed on such soils—even if soils so destitute of silicious parts are not (as I think to be very probable, but do not know them to be) as unfavorable to the growth of trees as are dry calcareous soils.

Practical application of the foregoing views, for the improvement and better cultivation of prairie lands.

The calcareous prairie soils, as well as all those not calcareous, are in general remarkably deficient in sand, and would be far more valuable but for this deficiency. This excess of aluminous earth (or pure clay) and not the calcareous matter, causes the remarkable and troublesome adhesiveness of these soils. Is it also not likely that to this defect of constitution is owing the great prevalence on prairie soils of the rust in cotton? It cannot be caused by the calcareous earth, as two of the specimens which were sent by Dr. Withers from land peculiarly subject to produce that disease, contained no carbonate of lime. But whether or not the *rust* is one of the evil effects of a great deficiency of sand, there are enough others, to make it very desirable to remedy this defect in soils otherwise so valuable. This might be done by the process of paring and burning the surface, as is often done in England, when a new or sod-covered field is brought from pasture into tillage. The first preparing of prairie soil for tillage, by the plough, is very laborious, and perhaps it would not be much more troublesome to pare and burn the sod. This would be the most perfect preparation for tillage; and the unrotted and redundant vegetable matter would be converted from a nuisance to a benefit; and the fine clay, burnt to brick-like particles, would form an artificial coarse sand, serving to open and cure the previous close texture of the soil. If the turf had already been conquered by tillage, burning clay in kilns, as was practised for manure in Europe, and by some in the Atlantic states, would serve the same purpose of providing a durable earthy ingredient acting mechanically like coarse sand. By paring and burning the surface of the soil, prairie lands might also be made more healthy. It is true that they are now considered generally healthy—the calcareous prairies especially. But though there may be lime enough, in most cases, to hold in combination the immense quantity of vegetable matter, still the latter must be greatly in excess in many cases; and when so, must be rapidly decomposing, after being ploughed, and evolve effluvia injurious

* Essay on Cal. Man. p. 44.

† Mould [*terreau*] can absorb double its weight of water without appearing moist; and after being dried, it draws from the atmosphere in less than twenty-four hours, a quantity of water, which may vary, according to the humidity of the atmosphere, from 80 to 100 per cent. of its weight.—*Berzelius*—quoted in Essay on Cal. Man. p. 169,

to health. If the prairie lands could by a miracle be suddenly and completely deprived of all their lime, the decomposition and waste in the air of their putrescent matter, now held combined and harmless, would make them as sickly as the western coast of Africa.

Exceptions and apparent contradictions explained.

Supposing these general causes to operate in the formation of prairie lands, the least reflection will show that their power and effects will be often greatly modified by other circumstances. It is well known that in prairie regions, the borders of rivers and small streams are generally clothed with trees. They are protected from the fires in some measure by the dampness of the earth, and because low bottoms are more sheltered from winds. The river also is a secure barrier against the flames, and therefore always guards one of its banks, at least. Even the close neighborhood of those exempted places, would diminish the violence of the flames; and spots abundantly calcareous, and lying high, might thus retain their wood growth. It would require that the flames should pass over a considerable space, and with a full supply of dry fuel, to acquire the requisite force and rapidity for producing destruction. Therefore the vicinity of the wooded banks of a river would not probably be changed from woodland to prairie, by any fires driven by winds *from* the river. To produce this effect, the winds which prevail in dry seasons must drive the flames *towards* the rivers, and downward between their forks. The existing state of things on the borders of the Mississippi and Missouri (as I have been told) accords well with this position. The north-west winds are generally dry, and blow with great violence; and wherever their direction is between the forks of streams and down their course, the prairie extends nearly or quite to the water's edge. But streams running from the opposite slope of the great valley, oppose the course and obstruct the effects of these fires—and the easterly winds, which would bear on them in like manner as to direction, are generally accompanied by rain. Therefore, in the last situation calcareous soils may retain their growth of trees, and in the former, soils well constituted to nourish and support them, may be brought to the state of poor prairie land.

If these general views are well founded, the manner in which prairies are formed can no longer be mistaken; and though a highly calcareous soil is deemed the most general and the most important means, the theory serves as satisfactorily to explain the existence of prairies on various other situations, though the soil be not calcareous.

Ancient prairie lands in the lime-stone region of Virginia.

In the foregoing observations I have limited the total absence of prairies in the Atlantic states to the eastern slope from the mountains to the sea, and to all poor land even among the mountains. In the rich limestone lands of Rockbridge and Clarke counties, and perhaps on similar soils elsewhere between the Blue Ridge and Alleghany mountains, there certainly were prairies at an early period. When that part of Virginia was first settled by the present race of inhabitants, large bodies of land were covered entirely by young sapling wood, and there were other indisputable proofs that at an earlier time few trees, if any, had been there growing. But though these lands are enough impregnated with lime (in some form) to be very rich, and to be favorable to the growth of grass, *they contain no car-*

*bonate of lime**—and therefore the land must have been brought to the prairie state slowly and with difficulty, under the long continued operation of annually repeated fires—and their intermission for a few years was enough to enable the soil to again throw up a new growth of young trees. These appearances were so well known in Rockbridge, that some very intelligent persons, born and reared in that county, have thence inferred that the wood cover of our country was every where comparatively recent, and that at some former and not very remote time, every part of this continent had been without trees; which is an example of very erroneous reasoning from particular to general facts.

Of soils rendered barren by excess of calcareous matter—and the fertility produced on them by irrigation.

The "bald prairies" of Alabama present the only known cases in the United States of bodies of land so highly calcareous as to be thereby lessened in productiveness. This effect will increase as exhausting cultivation shall lessen the vegetable ingredients of the soil; and probably (under a continuation of such tillage) the barren spots will extend widely into what now form their fertile margins. The quantity of vegetable matter accumulated in the highly calcareous prairie soils is now so great, that a very long course of exhausting tillage will be borne before sterility can be produced. Nevertheless, however remote may be that result, its occurrence is not the less sure, if exhausting tillage is pursued. Similar to our rich prairies probably was the original state of the now poor chalk downs of England, the almost barren plains of "Lousy" Champagne in France—and some of the still more hopeless deserts of Asia and Africa. The furnishing or retaining of a sufficiency of vegetable matter would cure this kind of barrenness, and more easily will prevent its extension beyond its present limits, in our own new country. In other countries, water alone, used for irrigation, has had the effect of making highly fertile, and keeping it so, land so calcareous that it would otherwise have been altogether barren. Many facts of this kind may be gathered from the writings of travellers; but their notices are very slight, and merely incidental, as unfortunately, none who have viewed and described these lands, possessed any agricultural knowledge. Some of these passages will be quoted. In some far remote future time, perhaps the overflowing wells of southern Alabama, may be used to irrigate the excessively calcareous soils, and to retain or restore their fertility.

Denon, in his *Travels in Egypt*, (Am. Ed. vol. ii., p. 4,) when at Siut, or Lycopolis, 2½ degrees south of Cairo, speaks thus of the Lybian range of mountains. "I found this, as I had supposed, a ruin of nature, formed of horizontal and regular strata of calcareous stones more or less crumbling, and of different shades of whiteness, divided at intervals with large mamillated and concentric flints, which appear to be the *nuclei*, or as it were, the bones of this vast chain, and seem to keep it together, and prevent its total destruction. This decomposition is daily happening by the impression of the salt air, which penetrates every part of the calcareous surface, decomposes it, and makes it, as it were, dissolve down in streams of sand, which are at first collected in heaps at the foot of the rock, and are then carried away by the winds, and encroaching gradually on the cultivated plains and the villages, change them into barrenness and desolation." The Lybian chain of mountains which runs nearly parallel with the Nile, there ap-

* Essay on Calcareous Manures, p. 31.

proaches very close to it, and the narrow strip of fertile and irrigated land between must necessarily have been deeply though gradually covered by the same calcareous sand; (indeed the continued operation of the like causes is raising, not only the borders, but even the bed of the Nile;) yet Denon mentions particularly the high state of cultivation seen in his next day's journey up the river. It is well known that wherever the waters of the Nile have been conveyed to irrigate these sands, an astonishing degree of fertility has been the immediate consequence; and that wherever the canals for this purpose have been permitted to become dry, (often the effect of political causes on this wretched population,) there is as sure a return to the former state of naked and barren sand. There is reason also to believe (though upon slighter foundation,) that portions of the great deserts of both Asia and Africa also are excessively calcareous, and owe their sterility to that cause, combined with the general absence of water. The only direct testimony as to this character of the soil, is in the following passage from Madden's Travels. He was in the desert between Egypt and Judea. "Next day we travelled all day long without seeing a single tree, or the smallest patch of verdure, or laying our eyes on any human being."——— "The soil was no longer sandy, but of a hard gravel, on which a carriage might be rolled from Salehie to Suez. At night we stopped at a well without water, and here I examined the soil, three feet below the surface; [for] two feet deep there is a superficial stratum of calcareous pebbles, and below that, a solid bed of limestone, which I believe to be the basis of the soil of all Egypt."—[p. 122, vol. ii., Am. Ed.]

"One thing is certain that wherever there is water, no matter in what part of the wilderness, there vegetation is to be found. The stopping up of the canals, and the want of irrigation, are the great causes of desolation which favor the extension of the desert. The country from San to Salehie, and probably to Suez, was formerly a cultivated country: the ruins of palaces, such as those of Zoan and that of Beit Pharoon, now in the middle of the desert, prove that the country around then must have been cultivated, and that at a very short period before our era."— Ib. p. 126.

Lieut. Burnes, who has recently published the very interesting account of his travels across central Asia, after describing, in various detached passages, the barren and often naked sands of the great Tartarian desert, over which he had been many weeks passing, and of the great scarcity of water even in the few wells, and the total want of it elsewhere, thus describes the approach to the river Moorghab, or Merve, and the effects of irrigation. "By the time the sun had set, we found ourselves among the ruins of forts and villages, now deserted, which rose in castellated groups over an extensive plain. I have observed that we were gradually emerging from the sand-hills, and these marks of human industry which we had now approached, were the ancient remnants of civilization of the famous kingdom of Merve, or Meroo. Before we had approached them, we had not wanted signs of our being delivered from the ocean of sand, since several flocks of birds had passed over us. As the mariner is assured by such indications that he nears land, we had the satisfaction of knowing that we were approaching water, after a journey of 150 miles [from the last habitable spot] through a sterile waste, where we had suffered considerable inconvenience from the want of it."——

"This river was formerly dammed above Merve, which turned the principal part of its waters to that neighborhood, and raised that city to the state of richness and opulence it once enjoyed. The dam was thrown down about 45 years ago by Shah Moorad, a king of Bokhara, and the river now only irrigates the country in its immediate vicinity. The inhabitants cultivate by irrigation, and every thing grows in rich luxuriance"——and where the

waters have been withdrawn, as stated above, the country is again a desert, and the former habitations are tenantless ruins. Another inhabited and cultivated spot in the desert is afterwards thus mentioned. "The country around Shurukhs is well watered with aqueducts, from the rivulet of Tejend, which is a little brackish, but its waters are usefully employed in fertilizing the fields. The soil is exceedingly rich, and possesses great aptness of agriculture; the seed is scattered and vegetates almost without labor. The harvest is rich."———"The inhabitants repeat a tradition that the first of men tilled in Shurukhs, which was his garden, while Serendib or Ceylon was his house! There is not a tree or a bush to enliven the landscape."

But these speculations, however plausible, would require many additional facts and proofs, to place them on as sure ground, as I flatter myself, the earlier part of this essay has done for the cause of the formation of prairies. However interesting it may be to the inquiring mind to extend views so far upon unexplored ground, prudence admonishes that in that way I have already exceeded the proper limits of argument sustained by known and undoubted facts.

Addendum.

Since the first publication of this piece (in 1835) there have come under my notice many statements of facts serving to confirm the positions assumed, and none to oppose them. Most of these statements are of more extended observations of other prairie soils and prairie regions, which are unnecessary to recite, as they agree generally and fully with the numerous particular examples cited in the foregoing pages. Some other of such evidences, on a different branch of the subject, will be here added, in confirmation of some of the positions before presented.

It was stated above, on the authority of Denon, that the soil of part of the sandy desert of Egypt (near Lycopolis) which is encroaching on and covering the rich borders of the Nile, consists of almost pure carbonate of lime, in calcareous sand formed by the continual disintegration of the range of Lybian mountains, there close adjacent. Also, on general authority and understanding of the facts, that this calcareous sand, though forming a barren and naked desert when dry, was made fertile wherever moistened naturally or artificially, by the waters of the Nile. Other facts were stated of places which are now and have long been naked deserts of dry sand, which are known to have been formerly watered by the industry of man, and were then highly fertile. And hence my inference that, wherever watering of barren sands had induced fertility, such sands must have been highly calcareous; and that the great abundance of the calcareous ingredient is both a cause of the barrenness of such soils when dry, and of their immediate change to productiveness and subsequent great fertility, when supplied with water. If, (to suppose a case.) instead of 70 per cent. of finely divided carbonate of lime in the soil of what is now a desert, there had been but 10 per cent. of that ingredient, and all the other parts had been silicious sand and clay, it may be presumed that the land would be much less barren than it is in these highly calcareous deserts, and with a moderate share of rain might be actually and highly fertile. In Egypt rain is a very rare occurrence; and therefore, except where watered naturally or artificially from the Nile, the highly calcareous sands are without moisture, and must necessarily constitute a perfectly barren desert.

The Lybian mountains being composed of calcareous rock, continually disintegrated and blown away by the winds in fine sand, would also alone serve to prove that the vast extent of desert sand thus spread over Egypt

must be largely composed of carbonate of lime. But that is not all. Malte-Brun says—"The analysis of the mud of the Nile gives nearly one half of argillaceous earth, about *one fourth of carbonate of lime*, the remainder consisting of water, oxide of iron, and *carbonate of magnesia*." (*Universal Geography, book lx.*) This is the deposite of the overflowings of the bounteous Nile, and which annually manures and preserves in the highest state of fertility, all the sands to which it is conveyed by the inundations. The same high authority furnishes some additional testimony, confirmatory of Denon's, as to the calcareous composition of soils of or near the deserts, or of rocks which by their disintegration must help to form the neighboring soil. "The mountains on the west side of the Nile seem to consist of limestone containing many shells. In those on the east side, serpentine and granite seem to form the highest ridges." "The valley leading to Cosseir [on the Red Sea] is covered with a sand partly calcareous, partly quartzose. The mountains are of limestone and sandstone." *Un. Geog. book lx.* "At the distance of eight miles from Cosseir the mountains suddenly change their character; a great part of them are limestone, or alabaster in strata. Here are found the debris of the *ostrea diluviana*."—"Towards the valley of Suez, the mountains are calcareous, and in several places composed of concreted shells." (*Ib. book lx.*)

The same author speaks thus of the country and desert of Barca, which is south of a part of Barbary, and north of the Zahara or great African desert. "Some call Barca a *desert*, and the interior certainly merits that name."—"The coast of Barca, once famed for its three-fold crops [as stated by Herodotus and Strabo] is now very ill cultivated; the wandering tribes of the desert allow no rest to the inhabitants, or security to their labors."—"A sandy plain at the bottom of the mountains [a part of the desert from Siwah to Andelah] presents on its surface an immense calcareous bank, which contains no traces of petrifaction, while the adjacent mountains are full of the remains of marine animals and shells. These are also met with here in large isolated heaps." (*Ib. book lxv.*)

Fezzan is surrounded by the desert, and seems to partake of the character of the desert in all respects, except in the close neighborhood of abundant water under-ground, and of its consequence, the exuberant fertility for which this country is celebrated. Malte-Brun says of Fezzan, "In the whole country there is no river or stream worthy of notice. The soil is a *deep sand* covering rocks, and sometimes a *calcareous* or argillaceous earth. There are numerous springs, which supply water for the purposes of agriculture. The whole of Fezzan, indeed, abounds in water at a moderate depth underground, derived, no doubt, from the rains which fall on hills more or less distant, perhaps on the confines of the desert, and though absorbed by the sand, find their level among the loose strata, across a broad extent of desert, till they become accessible in Fezzan, and impart to the country its characteristic fertility." (*Ib. book lxv.*) Though the author (or his translator) has used the word "springs," it is evident from the context that the sources of water are not what we here understand by springs, but are *wells*, requiring to be dug to reach the water to be thence drawn, and not furnishing flowing streams.

But even if there were no direct or positive evidence of these sands being calcareous, enough of indirect evidence would be presented in the well known fact that exuberant productiveness is induced wherever watering is applied. And wherever such results are stated by travellers to be produced on barren sands and in deserts, in any part of the world, it may be safely assumed that calcareous earth must form a sufficient, if not a superabundant portion of the soil. Unfortunately, no travellers through

sandy deserts and irrigated regions have been competent, and enough observant, to describe the agricultural qualities of the soils. I have not heard of there having been brought away any specimens of such remarkable soils, except in a single case; and for which one opportunity for obtaining direct proof of the ingredients we are indebted to the enlightened curiosity and investigating mind of an American lady. When I was lately (in 1842) at the Patent Office in Washington, I saw among many other collected subjects of curiosity, a small bottle labelled "Sand from the desert of Barca." It had been obtained and was presented by Mrs. Macauley, the wife of David S. Macauley, the American consul at Barca. I asked for and obtained a small portion of it, for the purpose of ascertaining its composition in regard to calcareous matter. Upon trial I found it to contain 49 per cent. of carbonate of lime! This sand is very fine, of a pale yellow color, and would offer to the eye, or to slight observation, no indication of being any thing else than almost pure silicious sand, slightly tinged by ferruginous matter.

It may seem to some readers that these speculations on sandy deserts, upon such few data furnished in positive facts, are a wide departure from the investigation of prairie soils; and that the deductions, even if established, are more curious than useful, and can lead to no practical result. But it is not so, if the lights thus obtained are properly applied. The facts here presented in connexion with others previously discussed, serve to show that the same cause, (a very large proportion of calcareous earth,) according to the existence or changes of other circumstances, may produce in soils either the highest degree of fertility, or the most complete sterility. These modifying circumstances are the presence in the soil of much putrescent matter, the accumulation of ages of repose under grass, or of abundance of water—or of the absence or great deficiency of both. It may be merely a matter of curious speculation, however correctly deduced from the positions here maintained, that it is possible, and perhaps would be profitable, merely by raising water to the surface, to bring to a state of productiveness most of the naked and burning deserts of Africa. But another deduction is not merely a matter for idle and amusing speculation, but is a most important truth, and strictly applicable to practice; which is, that the rich prairie regions of the west and south-west of the United States and of Texas, if continued to be scourged unremittingly by exhausting tillage, will finally become deserts as barren as those of Lybia and Barca.

NOTE VII.—*Extension of subject from pp. 57 and 140.*

RECENTLY OBSERVED POWERS OF CALCAREOUS EARTH, FOR INCREASING THE PRODUCTIVENESS OF LAND AND THE HEALTHFULNESS OF THE ATMOSPHERE.

It was stated at pages 103–4, that though the practical results of applications of calcareous manures conformed strictly to the theory of their action as previously laid down, yet they exceeded the measure or amount of effect which would have been anticipated from the theory alone. Since a large portion of this work has been printed, I have first heard of the discovery, by Dr. William L. Wight, of Goochland, of a before unknown property of calcareous earth, which operates to increase in an important degree its fertilizing power, and also its health-preserving power. I was favored by a mutual friend with the perusal of a rough draught of an essay in which these views were incidentally presented, and which Dr. Wight had designed for publication in a medical journal. I immediately requested him to communicate these particular and interesting views, in such form as would suit agricultural and general readers, for publication in the Farmers' Register. To this he assented; and I had hoped before this time to have been enabled thus to present the article entire to the public, in which case, it might here be merely referred to, as already in the possession of my readers. The communication has been received; but too late to be included in the few remaining pages of the current volume of the Farmers' Register, or to precede the appearance of this note; though it will appear at length in the first number of the second series of that journal.

Before stating the newly discovered powers above referred to, it is necessary to introduce them by some general statements of established or received opinions of vegetable and animal life and functions.

The atmosphere is composed mainly of oxygen and nitrogen gases, (and which two alone are deemed essential to the constitution of atmospheric air) with a very small but universally occurring admixture of carbonic acid gas. The oxygen gas (formerly termed "vital air," from its admitted quality,) is that part of the atmosphere which is essential to the life of breathing animals, and which is diluted to form atmospheric air by the mixture of nitrogen gas, and also by the small and perhaps accidental, but always present carbonic acid gas, either of which alone is not only incapable of supporting life, but to breathe which is deadly, and immediate in its fatal effects. Hence it has been supposed, and it is difficult to deny the positions, that to give larger supplies of oxygen gas to the atmosphere must render it more healthful, and to increase the quantity of carbonic acid gas must render it less so. It must be admitted, however, that these deductions, though in accordance with the known and opposite qualities of these different gases, and with reason, are not sustained by the analyses which have been made of atmospheric air in various places. For if these analyses are to be entirely confided in, they would show that in all situations, the highest or the lowest, the most pure and healthy and the most pestilential and fatal to human life, the proportion of oxygen in the air is precisely the same.

By the respiration of animals, the atmospheric air is partially decomposed, and the relative amounts of its ingredients altered, at least for the time. Some of the oxygen gas of the air inhaled is retained by the lungs and given to the blood; and some nearly formed carbonic acid gas is given out from the lungs continually, and added to the atmosphere. Thus, the breathing, or the existence of animals, if acting alone, or not counteracted, would serve continually to deteriorate the purity of the atmosphere, and to render it less conducive to the support of healthy animal life.

But to this very general operation of animal life, there is as general and as operative a countervailing action in vegetable life. Carbonic acid gas is essential to the health and growth of plants, and serves to furnish them with a very large if not indeed their larger proportion of bulk and substance. All that part of every vegetable substance which can be converted to charcoal (or carbon) has been furnished to the plant from the atmosphere in the shape of carbonic acid gas, which is a combination of oxygen gas and carbon. The leaves of growing plants absorb this ingredient from the atmosphere, and retain and fix the carbon as part of their substance, and evolve the pure oxygen; thus taking from the air some of its poisonous ingredient, and adding to it new supplies of the purifying or health-supporting gas.*

It follows necessarily from these premises that if by any means these universal powers and continual action of plants, to absorb carbonic acid gas and evolve oxygen gas, be in any manner increased, that proportional increase must be given by the first to the growth of the plant, and by the second, proportional purification and healthiness to the atmosphere.

To these general views and positions the recent observations of Dr. Wight apply admirably. He ascertained, by a series of careful and well conducted and repeated experiments, that the diffusion of carbonate of lime in water with which plants were nourished, caused in the plants a great and remarkable increase of both the above named actions; so that they absorbed much more, in some cases a quadrupled quantity, of carbonic acid, and evolved as large an increased quantity of oxygen gas. If this be so—and the manner of the experiments stated leaves no ground to doubt the accuracy of their conduct, or of their results—then there can be no question of the following important deductions: that besides all other modes and powers of fertilizing action of lime in soil, as maintained in this essay, it also causes plants to draw from the atmosphere a very large accession of nutriment; and to increase in proportion the measure of their ordinary purification of the atmosphere. And therefore, these interesting and new observations serve to confirm and to show additional and important reasons for the operation of calcareous manures both for increasing the productiveness of lands, and of lessening the amount of disease among the residents thereon and in the vicinity.

NOTE VIII.—*Extension of subject from page* 161.

DIRECTIONS FOR BURNING AND APPLYING OYSTER-SHELL LIME.

The following directions and remarks may be useful to some of those persons to whom shell-lime will be cheaper than either marl or stone lime.

Oyster-shells are brought by vessels to the landing places of the purchasers on the James river, and sold on board usually at 62½ cents the hogshead, of 18 heaped bushels. Where fuel is plenty, the shells and dry pine wood, in alternate layers, are built up in a heap of cubical form for burning. In this manner, if judiciously executed, 12 cords of wood are sufficient to burn 100 hogsheads of shells to quick-lime. A more careful mode of burning was used by the late Fielding Lewis, of Weyanoke, which was described in an account of his farming in the Farmers' Register, for June, 1833, and which will be copied below, together with his mode of application;

* As this is the greatly preponderating action of vegetables, the smaller reverse operation (which takes place at night) is passed over, as unnecessary to be referred to more fully than in this manner.

which is still deemed the best for separating the particles of lime and spreading it equally over the land; and also (I will add, as another important object,) to permit the quick-lime by exposure to become again combined with carbonic acid in the shortest time.

"Close kilns, with walls of brick or stone, have not yet been used to burn oyster shells for manure; and until fuel becomes more costly than the additional transportation of the lime, it will be cheaper to use wooden kilns. What are commonly called lime kilns are merely heaps of wood and shells, built up in a somewhat cubical form, by which the burning is imperfectly performed at great expense of fuel though without much trouble. Mr. Lewis burns his shells in the following manner. A pen of sixteen or seventeen feet square, is built of round green pine logs, (notched where they lock, so as to come as close together as their form will allow,) and with a floor of similar logs, chinked with smaller pieces, so as to prevent the shells dropping through. The bottom logs of the kiln are laid on four corner blocks, of twelve inches, so as to leave a vacancy of twelve or fifteen inches between the earth and the bottom of the floor, which is to be packed closely with dry wood. The walls of the pen are raised about nine feet; and about one hundred logs of six to eight inches through (which these now put up seemed to be,) usually serve for the floor and side walls. The shells are thrown in, and in layers of different degrees of thickness, according to their order, and separated by thin layers of pine wood, cut eight feet long, and split to the usual size for fuel. The size of the last kiln burnt by Mr. L., according to his memorandum book, was as follows:

Kiln 17 feet square and 9 feet high, inside measure.

The lowest bed of shells 8 inches (he thinks it might as well have been 12 inches.)

The second bed of shells	12 inches.
third	16
fourth	20
fifth	15
sixth	6

The layers of wood between were equal, and about six inches. The kiln took one hundred hogsheads of shells, and consumed ten cords of wood in the layers, and three more of foundation or kindling wood. The kiln should be fired in calm weather; and if the wind afterwards rises, it should be kept off as much as possible by a screen of brush, or whatever may be most convenient.

The burning (in preference) is done in March, or as soon after as may be. The newly burnt shells are carted to the field as soon as they are cold enough, and deposited in small parcels of a measured heaped half bushel each, at distances of six yards. The field is previously ploughed, and marked off carefully in checks of six yards square. These small heaps of shells are immediately covered completely, but not heavily, by the surrounding earth being drawn over them with broad hoes. If a heavy rain was to catch the lime before this covering, much of it would become a wet sticky mortar, difficult to manage, and impossible to distribute equally. When secured in the heaps, the moisture absorbed from the earth will usually slake the lime in forty-eight hours. The heaps are then cut down and mixed with hoes, and carefully spread so as to cover the field very equally. The land is then well harrowed, more effectually to distribute and mix the lime with the soil. The quantity applied to the acre is about seventy bushels of the burnt and unslaked shells, which quantity is produced by burning 6 hogsheads (108 bushels) of shells; and the same, if well burnt, will swell in slacking to 125 or 130 bushels. The lime is always put on a part of the field of the fourth

year, and is put under field peas the same year. The red, or cow pea, is preferred, being considered most profitable for live stock; and as that is a late kind, it should be planted as soon as possible after the 20th of April, that the crop may mature. Two after ploughings and one slight hand weeding serve to cultivate the crop; and its product, Mr. L. thinks, though, without having made any experiment or careful estimate, usually pays the whole expense of the liming."—*F. Register, vol. i. p.* 18.

The shells sold to the farmers are obtained at the various landings on York and the lower James river and their tributaries, where oysters are opened in great quantities for sale. On some of the lands bordering the Potomac, there are much cheaper and universal sources of supply, in ancient accumulation, of shells called "Indian banks," and which are now used to burn lime from for manure for farms in the Northern Neck. Very recently there has been brought into use a new source of supply on James river. This is the young living oysters and old shells which together form entire shoals in some parts of the river, and which are raked up in mass to load the vessels. These shells are sold at 50 cents the hogshead or less. As these are mostly small and thin shells, they could more easily than ordinary shells be pulverized by a mill-stone running on its circumference, as in a tanner's bark mill; and in this manner all the rich animal matter would be preserved, which is destroyed by burning.

NOTE IX.

ON THE SOURCES OF MALARIA, OR OF AUTUMNAL DISEASES, IN VIRGINIA, AND THE MEANS OF REMEDY AND PREVENTION.

(*From the Farmers' Register of July*, 1838.)

Throughout the course of publication of the Farmers' Register, it has been one of the main objects of the editor to attract attention to the causes and effects of malaria, or unhealthy marsh effluvia, and to enforce his views as to the means of restraining or preventing this greatest of the evils under which the eastern half of Virginia suffers. To forward this end, every fit opportunity has been availed of; and the subject has been treated, directly and at length, or incidentally and slightly, in various articles in these volumes. But there has been found but little if any encouragement to persevere in this course. The editor has, alone, and without any certain evidence of approval of his views and his course, and certainly without any practical adoption of his recommendations, labored in this cause, which, to his understanding, demands the support of all, on considerations of economy and agricultural improvement and profit, as well as on the more important grounds of the strength or frailty of the tenure by which the people of half of our entire territory possess and enjoy health, happiness, and even life. It is under such impressions of the high importance of the whole subject, that the readers of this journal are again invited to its consideration; and, probably, for the last time, by the present writer, if there continues to be no more interest excited, and action produced, in regard to the evils existing, and which are multiplied ten-fold in power by the ignorant and careless legislation of this commonwealth.

The views of the writer on this subject were presented generally, and at some length, in an editorial article (pp. 41 to 43) in vol. v., Farmers' Register, on the causes of and means for preventing the formation and the effects of malaria in eastern Virginia; and also in sundry shorter incidental pas-

sages in each of all the volumes, in connexion with articles on marshes, mill-ponds, and canals, &c. But as it would be requiring too much of readers that they should either remember, or carefully refer to these various articles, a general, though slight view of the whole subject will be here presented, sustained by additional facts, which have been recently learned by personal inquiry and observation.

That the common autumnal or bilious diseases of eastern Virginia, and especially of the tide-water portion, which is most subjected to them, are principally caused by the effluvia rising from wet lands, is a matter in which all concur. The general difference between the presence of these disorders, in low, wet, or marshy countries, and their absence, or scarcity, in mountainous and dry regions, is so great, that none can mistake, or differ about, the *general* causes and effects. But from this general opinion, which is true in the main, (though having numerous and important exceptions,) there is deduced the erroneous conclusion, that these opposite general effects produced on health, in extensive regions either generally low and wet, or generally hilly and dry, are produced by these opposite natural features, and cannot be very materially altered by art; as art cannot materially alter the natural character of the land. Or, in other words, that nature has made one great region low and sickly, and another high and healthy; and that man cannot do much to counteract the law of nature in either case. Perhaps none may maintain this position, in argument, without admitting partial exceptions in numerous particular cases and localities. Indeed, every man will say that care may lessen the causes and mitigate the operation of malaria, in a sickly region, or increase both in a healthy one. But, judging from the action of both the people and their laws, which speaks more strongly than words, it may be inferred that it is a general belief that such bendings of nature from her course can be but slight, in particular cases, and scarcely worth estimating on a broad scale, or through an extensive country, In entire conformity with this supposition, it is a notorious fact that very few individuals in Virginia have done any thing considerable, or on system, to protect their dwelling places from malaria; and the government has not only done nothing for general protection, but has actually caused the worst of the existing evils, and is encouraging their continued increase and aggravation, by the fixed legal policy of the country; which permits the raising of mill-ponds, that are productive of little else than malaria and disease; and indirectly, but effectually, forbids the drainage of extensive swamps. The production and deadly effects of malaria, in eastern Virginia, for the greater part, is to be charged, not to the laws of God, but to the laws of man; which, in this respect, operate to put away or sacrifice some of the most precious of God's blessings, offered to all, to gratify the whims, or the blind and often mistaken avarice, of a few individuals. There are, doubtless, great *natural* differences as to the sickliness of differently situated regions; as between the low tide-water region of Virginia, the central or hilly, and also the mountainous region. But, in their natural state, before damaged by mill-ponds and other of man's miscalled improvements, the low-country was probably less afflicted by malaria than the hilly parts now are, or may be rendered by the full extension of these injurious operations of man. This is a matter of mere supposition, and cannot possibly be subjected to the rigid test of proof by known facts. But, from reasoning, and inferences from such facts as are known, it seems most probable that some of the now most sickly counties on tide-water were, at the first settlement of the country, less sickly than the hilly and originally very healthy county of Brunswick, for example, has been in latter years.

Even the very important fact of increased and increasing sickliness in this country, is entirely without support from any known written authority; and the whole subject has been so little examined, or thought of, that to most readers the position here assumed may be entirely new. There are no statistics of health to which we can refer for proof. But general and historical facts, few as they are, if fairly considered, will suffice to place the question beyond dispute.

Before proceeding further in this part of the argument, let me remark that I am opposed in the outset, and shall be opposed throughout, by the reluctance felt by every individual to believe, or if believing, to admit, that his particular property, or place of residence, is more sickly than others, or has become more so than in former times. This self-delusion, and consequent, though perhaps undesigned effort to deceive others, is almost universal. Each man claims for his own place more healthiness than in truth ought to be admitted; and the combined effect of all these individual claims, is to maintain that the whole country is more healthy than is true, and more so than each individual would have claimed for it, with the exception of his own farm and his own neighborhood. It is against this universal prejudice and obstruction that I have had to contend in seeking for facts, and shall have to contend in argument; and, with such opposition, there is but small hope of maintaining my ground, or producing conviction of the soundness of my views, in the minds of those who have so prejudged the case.

One of the strongest proofs of the greater former healthiness of the low country, was the settlement of our English ancestors having been made and continued at Jamestown. It was on May 13th, when they landed; and now, a residence on that spot, or in that region, continued for five months after that time of the year, would be fatal to half of the strangers from a northern climate, even though provided with all the comforts and necessaries which a long-settled country affords, and all of which the first settlers most deplorably needed. It is true, that for some years after the first settlement, there was much sickness, and numerous deaths; and that in fact the infant colony was more than once on the point of extinction. But these diseases and deaths do not seem, from the direct and the still stronger indirect testimony of history, to have been attributed by the sufferers to an unhealthy location; and there were sufficient other causes for all that was suffered, in the usual and unavoidable privations of the first colonists of a new and savage country, added to the extreme improvidence and mismanagement of these settlers, and their government, as detailed in history. Even after several years had passed, and though cultivating a very fertile soil, and aided by annual supplies of food from England, and with all the resources of trade with the savages, hunting and fishing, still, want of food was one of the greatest causes of disease and death. Of course, there must have been, under any circumstances, more or less of disease caused by malaria; and although any predisposition to such disease, naturally induced, must have been violently urged to action, and aggravated to ten-fold malignity, by hunger, intemperance, exposure of every kind, depression of spirits, and every other painful emotion of the minds of men in such desperate straits, still, even with all these aids, the prevalence of autumnal diseases, the effect of malaria, was not so conspicuous as to stamp the character of sickliness on the location, or to induce even the proposition to remove the colony, or afterwards its seat of government, to a much higher or more healthy situation. The unavoidable inference seems to be, that the great sickliness of the early settlers was not attributed by themselves to the climate. Yet, this was a question on which they could not possibly have been deceived. And even if most others had been deceived, by ignorance, and the want of ex-

perience of the effects of malaria, this could not have been the case with Smith, the most efficient director, and the true founder of the colony; who would have known better, not only by his general intelligence, but also by his experience of such effects, gained in his campaigns against the Turks. It may be alleged, that fear of the savages, stronger than the dread of disease, caused the choice of, and after continuance on, an unhealthy spot, because it was more easily guarded on the land-side, and perfectly accessible to ships. But spots equally favorable for defence, and on deep water, might have been selected at first, much higher up the river; and yet Jamestown and its immediate neighborhood continued to be the chief place in Virginia, after the power of the savages had been crushed, and settlements had been extended to distant and inland places. The proof of my position would be sufficiently proved by any attempt made now to settle Englishmen, just arrived, on the border of almost any of our tide-waters, and especially about the junction of the salt and fresh waters. Several such trials have been made with foreign laborers; but the first autumn was enough to put an end to each experiment, by inflicting so much disease and death as to prevent any of the foreigners remaining through another season, who could possibly move away.

There can be but little doubt also, but there was much less of autumnal diseases, or at least of violent and fatal diseases, before the revolutionary war than now. There was no such thing then, as the healthy residents leaving home in summer, as is so usual now, to spend the sickly season among the mountains, or at the north; nor does it appear that there was much suffering for want of such resources, although the climate must even then have become very far more unhealthy than in the early times of the colony.

Another striking proof of the increased tendency of the country to produce disease, even within the last sixty years, is presented by history, in the circumstances of the occupation of Yorktown by the British army in 1781, and the siege carried on by the American army; and especially in regard to the hastily-levied militia from the mountains, and other high and healthy parts of Virginia. Cornwallis chose his position first in Portsmouth, and afterwards in Yorktown, with a view to health, as well as defence, to await the arrival of reinforcements from New York. His army was concentrated at Yorktown, August 22. Washington reached Williamsburg, September 14, and the American army moved on thence to invest Yorktown, Sept. 30, and the surrender of the British army was made on Oct. 19th. Thus, both armies were exposed to the worst part of the malaria season, and the British army to the whole of it. Among the besiegers were raw militia, just raised for the occasion, from Rockbridge county, (of which portion I have been more particularly informed,) and probably from sundry others of the mountain counties. There was certainly much sickness, and especially among the British troops; but not more than is usual in camps, and especially in besieged camps, suffering all the privations incidental to the confined situation. It does not appear, from the very slight notices in history, that there was more sickness than might have been expected if the same circumstance had occurred in the hilly middle region of Virginia. Yet, if the like circumstances could occur now, it can scarcely be doubted but that every soldier, not already acclimated, and accustomed to malaria, would be made sick; and that probably half of those just brought from breathing the pure mountain air, would never return home.

Another indirect proof is presented in the great and deplorable decline of most of the lower counties of Virginia in wealth, and in the usual accompaniments of wealth, which formerly made a residence delightful in many neighborhoods in which there is nothing now left to invite any one to re-

main. It is true that other causes, political and economical, have concurred to produce this result. But the most potent of the several causes was the slow and silent, but continual and increasing warfare on the health of body and mind, made by the action of malaria. By its operation, when scarcely amounting in effect to positive and known disease, the mind is sickened even more than the body. The buoyant spirits are tamed—energy is relaxed—the keen appetite for enjoyment (which is the greater part of happiness) is lost; and the victims of malaria cease to strive, or to enjoy; and either sink into apathy and listlessness, or, urged by discontent, more than by any remains of energy, take the final step of emigration to the western wilderness.

But the upper country furnishes still stronger evidence, because of positive and unquestionable facts, to prove an increase of the product and effect of malaria. The hilly country between the falls of the rivers and the nearest mountain-range, with the exception of some comparatively small spots, on swamps and rivers, was formerly as free from this scourge as is now the mountain region. But the number and the extent of the unhealthy places have greatly increased within the memory of those now living; and some large districts have been, in particular seasons, as subject to bilious diseases, and still more to violent ones, than the tide-water region. Indeed, in very many places, universally believed (unless by the mill-owners) to be injuriously affected by the neighborhood of mill-ponds, these effects of malaria are of as regular recurrence in autumn, as on places near to any of the marshes of the low country; and are much more dangerous.

The third and highest region seems destined, notwithstanding its better defence in mountain sides and peaks, and the rarity of flat surface on which to form wide and shallow ponds, to take its turn next, as the victim of malaria. Already, in that part of the mountain region in and about Frederick county, there have been particular autumns which seemed almost pestilential. And though such cases of general and virulent disease are rare, particular cases of autumnal diseases are now frequent in many such places where they were rarely heard of thirty years ago.

These statements may be considered by some as exaggerated or unfounded—and, by others, if admitted to be true, considered as showing the want of both patriotism and policy, in the writer's thus exposing the enormous existing and still growing evils under which the country suffers. In regard to the former point, I admit, in advance, the scarcity of particular and positive facts, to serve as proofs, which is found throughout the whole subject; and that among the existing difficulties of obtaining such facts, (and still more by a single and unaided individual, who has had little opportunity to make proper researches,) I have to rely mostly upon general and loose opinions, and deductions from general facts. Hence there is much liability of mistake. But if the public can in any way be driven to the examination of this subject, and numerous individuals be excited to search for facts, whether to sustain or to oppose my views, the arrangement and presentation of such facts will serve as materials, which are now almost totally wanting, and will enable this all-important question to be hereafter properly discussed and correctly determined.

If there were no hope for relief, there would certainly be no use in exposing or dwelling upon these distresses of our people. But, though nothing yet has been done for relief, nor does it seem to have entered the imagination of our legislators, and though all they have yet done has been to add strength to the evil, still it is my confident opinion, that relief may be furnished for this sorest evil of the land, and furnished easily and profitably; and that it is perfectly within the power of man to dry up the most

fruitful sources of malaria, and to bring the whole, or very nearly the whole of Virginia, to a state as healthy as that of any other country in the world. If such a result is indeed attainable, it is worth making every possible exertion for; and nothing will induce the smallest exertion, either by the people or the government, except a full exposure of the enormity of the evil which presses upon the country.

It is not my purpose to attempt to investigate the cause and trace the mode of operation of malaria. Though worthy of every care and labor as a scientific question, it is one which as yet has entirely baffled every attempt at exposition. But though it is as yet unknown what is the chemical character of this subtle fluid, and what are the precise circumstances under which it is evolved, and what is the manner in which it exerts its baneful influence—still the main and most important points admit of no question. Thus, and in general, all persons, from the most ignorant to the most learned, agree that there is *something* which rises into the atmosphere in hot weather, from marshy ground and stagnant waters, which tends to produce the common autumnal fevers in those who are much exposed to breathing the air contaminated by this admixture.

Though I speak of malaria as an aeriform fluid, or gaseous product, it is not designed to found my argument upon the truth of that opinion. Though for convenience, as well as because inclining to the belief, malaria is here spoken of as a material aeriform product, yet, it may be also used as a term to designate the particular *condition of circumstances* produced by certain causes, which condition operates to produce and strengthen autumnal diseases. Still less do I mean to maintain that malaria, even if material, is of any one kind of gas, or any particular combination of several kinds. Besides these, there are many other common points on which the learned investigators of malaria totally disagree; and so much does each one insist upon deducing general principles from his own particular facts, (or supposed facts,) and so slightly and incorrectly have such facts been observed, that the general reader becomes lost in the contradictory positions of different instructers. Thus, judging from particular and isolated observations, with some writers, there is no condition of circumstances which will not sometimes in a warm climate produce malaria; and with others, upon equally partial and imperfect observation of other facts, the production is denied to be usually caused by any of the circumstances which are generally deemed the most certain and fruitful sources. One writer, perhaps, has known an exemption from disease in those who lived close to a stinking marsh, or a stagnant pond; and hence he denies that these are sources of malaria, and accordingly searches for them in other circumstances. Another has known the effects of malaria on troops encamped in a high defile in the mountains of Spain, where the soil was dry and stony, and no water except rapidly flowing rivulets, and the place some miles distant from the nearest marsh or lake. Hence he concludes, that even such a locality as this, in certain (unknown) circumstances, throws out abundance of malaria. Considering the circumstances under which most of the works on malaria have been written, it would be strange if they were not quite contradictory. The authors of most of them were army-surgeons and physicians, who observed the effects of malaria in some deadly region, upon soldiers not at all acclimated. Perhaps the author was confined to a garrison, or at least limited in his observations to the line of march of an invading army; and in a country to which he was totally a stranger, and among a hostile people, whose opinions he could not learn, and whose language he probably did not understand. If a physician of Lord Cornwallis' army, who had merely accompanied his march through Virginia, and been cooped up in Yorktown

during the siege, had written a treatise on the diseases of the country, he would have been better prepared to treat of them than most of those who have essayed such tasks; and he probably would have considered as a regular disease of the country the fatal "jail-fever," which swept off in numbers the absconding slaves who had joined the British army, and were crowded together in Yorktown until the surrender, and which form of disease has never been known in Virginia before, or since.

All agree that decaying and putrefying vegetable matter is one of the greatest, if not the only source of malaria. Of course, then, in addition to the sufficient abundance of the material, the circumstances most conducive to its putrefaction must be the most favorable to the production of malaria.

The presence of moisture, a certain degree of heat, and the access of air, are circumstances *essential* to putrefaction, and of course to the production of malaria; and neither can take place without the aid of all three of these things. Much moisture would be less favorable than a less quantity; and entire covering by water would, by excluding air, nearly prevent fermentation, and its consequence, the formation and escape of malaria.

It is also one of the few settled points, among scientific investigators, that malaria is very light, at least when warmed by the sun; and hence the fact known to many in this country, that those who live on the borders of marshes, and of mill-ponds, sometimes escape all injury from their exhalations, when others, who live on high hills, and at much greater distances from the sources, suffer greatly by the disease produced. Facts of this kind are numerous, and of regular annual occurrence, in Gloucester county. The whole of the wide and very level low-grounds furnish residences very healthy, compared to the tide-water region in general; though intersected in every direction by tide-waters, and though there still remains much swamp land unreclaimed, such as the whole body of low-ground was when in a state of nature. But the high, dry and hilly land, which forms the ridge of the county, is less healthy; and the highly elevated and beautiful sites of mansion-houses overlooking the low-grounds are universally sickly in autumn.

If all the facts in regard to the action of malaria were as regular and uniform as this one just stated is in Gloucester, there would be far less doubt on the subject. It is the uniform character of that county, in its high-land, low-ground, and also the water, and the long extent of each, which causes these effects to be so uniform there. Owing to causes stated in the description of the low-grounds of Gloucester, (Farmers' Register, page 178, vol. vi.,) there is but little malaria evolved there; and if that, as supposed, rises by its greater levity, the regular daily sea-breeze must cause it to float towards the high-lands; and the long and regular line of ridge cannot fail to receive it, and in not very different proportions. But in most other situations, even though malaria should be produced in great quantity and with direful effects, yet these effects are so extremely irregular, in the places, the times, and the intensity of their operation, that they cannot be certainly traced to their true source; and therefore, that source may remain scarcely suspected, while it is dealing out death somewhere in almost every season. Away from the vicinity of the sea, nothing can be more irregular than the winds; yet, supposing a mill-pond to produce a regular and large supply of malaria every autumn, (though that supply is itself extremely irregular,) it depends upon the direction, force, and continuance of every change of wind, whether and where, and to what extent the malaria will produce disease. It is therefore not at all strange, nor opposed, as is thought by some, to the regular annual production of malaria or causes of sickness by each mill-pond, that the visitations of sickness, at any

one place, should be very irregular, and the difference be often totally inexplicable from any known causes, or variation of circumstances.

According to the views presented, there must be more or less malaria (or the gaseous products which, under certain conditions, form malaria,) evolved in every country where there is much vegetable matter to ferment, and sufficient warmth of climate to carry on fermentation. But, in the small quantity which is unavoidably extricated in every such temperate and fertile country, these products seem to be harmless. Perhaps a small quantity is absorbed as food by growing plants, and this aids the production of the earth. If so, this beneficial operation is made easy by another quality of malaria, which is well established as true. This is, that though it is so expanded by the sun as to rise above the lower air, still it remains on the surface of the earth in the night, after being extricated, or perhaps descends again from above, when condensed by the cold night air, and of course lies in contact, through the night, with growing plants. Hence it is, that sleeping on the ground, or in the lowest apartments, and being exposed to the night-air, invites the attacks and increases the virulence of malaria; and hence also it is, that the keeping of fires at night, even in warm weather, has been found highly useful to health, in places much subject to autumnal fevers.

Though it may then be theoretically true that every good soil, in warm or temperate climates, is throwing out malaria to a certain extent, it is only large quantities that are hurtful; and in practice, we have only, if possible, to avoid the formation of the hurtful excess of the products of fermentation. If, in lower Virginia, we can guard against the existing and increasing excess of malaria, our situation would be one of the healthiest in the world. For while we are comparatively free from the many and fatal disorders of the lungs to which the inhabitants of northern, and what are usually and improperly called *healthy* countries are peculiarly subject, we have no source of disease peculiar to our location, save this one, which, I fully believe, it is within our power to guard against.

Putrefying animal matter alone, however offensive in scent, is supposed not to produce malaria. It cannot be doubted but that decomposing vegetable matter is its source, because there is no production of it where there is no such material. Still, vegetable matter alone, or even when mixed with some putrescent animal matter, does not seem generally to produce malaria in great quantity, or with manifestly injurious effects on health. Thus, the gradual fermentation and rotting of the litter in cattle-yards, when left to stand through summer and autumn, or when the same was heaped and so left, (as was formerly the general practice in lower Virginia on all farms where manure was an object of care,) never was known to be certainly and highly injurious to the residents on the farm. Doubtless, malaria, and to an injurious extent, was always thus produced; but I have never known a sensible difference in regard to health, between years when either of the practices above-named were pursued, and when the material was carried out and applied to the fields in the spring, before fermenting. Yet, if judged by the test of some of the causes and effects as described and reasoned from by writers on malaria, one well-filled yard of litter, rotting through summer, ought to have produced enough malaria to kill half the inhabitants of the farm; and effects, in general, which would have been so disastrous, and so sure, as to leave no doubt of the cause of the evils, and of the absolute necessity of preventing their future recurrence.

But the putrefaction of vegetable matter, mixed with other things, as earth and water, and under peculiar circumstances, (though neither the precise admixture nor the circumstances are known,) produces disease to

such extent, that there is no doubting or mistaking the connexion of causes and effects. Such sure and abundant sources of malaria are the following materials: 1st, The putrid and stinking water of stagnant ponds, partially dried by the heat of summer. 2d, The mud bottoms of such ponds, or of streams reduced by drought, rich in decomposed vegetable matter, and left bare of water only in summer. 3d, Fresh-water marshes, of vegetable soil, frequently, but not regularly, covered by the tides. 4th, Fresh-water marshes, laid dry by embankments, and thereby permitted to rot away rapidly. 5th, The meeting of salt and fresh waters on land full of vegetable matter. Of these several and most important sources of malaria, I deem the third (fresh-water marshes in their natural state) to be the least hurtful; and that the sources numbered 1st, 2d, 4th, and 5th, increase in virulence in the order in which they are named. The greater evils produced by the last are universally admitted, but still by an erroneous deduction from the premises. The belt of the tide-water region of Virginia, in which the fresh water flowing down the rivers mingles with the refluent salt water from the ocean, is well known to be more subject to autumnal diseases than any other extensive space in the country. The breadth of this belt varies much in different seasons. The parts of the rivers in which the fresh and salt waters meet, and where each alternately has possession as the tide ebbs or flows, may be but a few miles wide, and even that space is not stationary. But if the limits of this belt be fixed by the highest points to which the rivers have been known to be brackish in driest summers, and by the lowest points where they are fresh in winter, then this belt may be considered for the time as 40 or 50 miles wide, and, in length, stretching across all the tide-waters of the state. But in the much narrower space where this mingling of the salt and fresh waters usually takes place during the heat of summer, malaria acts with most intensity. Hence the general opinion, that it is simply the meeting and mingling of the fresh and salt waters which cause disease. This is not so, or but in a very slight degree. It is either the passage of fresh-water over salt-water marshes, or of salt-water over fresh-water marshes, that causes the great production of malaria, and disease. This is an important distinction, and the truth or error of the position deserves the most careful investigation. If the mere mingling of the waters were the cause of sickliness, any relief for this part of the evil would be hopeless, as the waters *must* meet and mix together *somewhere*. But if it be as I suppose, the evil may be greatly restrained by works of art, or by simply preventing the unnatural accumulation of vast reservoirs of fresh water in mill-ponds, which when discharged, by breaches in the dams, or by opening the flood-gates, overflow salt-marshes, which the natural or unobstructed stream never could have covered.

Salt-water marshes, not touched by fresh-water streams, are not unhealthy to any considerable extent. This is susceptible of proof by innumerable examples in Virginia on the borders of the ocean, or of the waters of the Chesapeake bay. It is rare, however, to find a large salt-marsh attached to extensive high-land, which is not reached by some small stream; and every salt-marsh of course must sometimes be well washed and freshened by the heaviest falls of rain. Therefore all must, slightly and at some times, be prejudicial to health. These, however, are exceptions of but small practical or sensible operation.

The view here taken of the manner in which malaria is produced most certainly, and acts most injuriously, though not sustained by any known authority in this country, nor by any other precisely as stated here, is not therefore presented as original. I derived it, and thence deduced my application to this country in a modified form, from the interesting report on

the malaria of Italy, by Gaetano Georgini, of which the substance was published in two different papers in the Farmers' Register, (p. 502 of vol. iv., and 460 of vol. v.) In this report the author shows, by the most conclusive argument and facts, that the irregular irruptions of sea-water over tracts of marshes, or other low-grounds, of fresh-water alluvial formation, caused the long continued and worst effects of malaria; and that by simply guarding against the entrance of sea-water, the country was restored permanently to healthiness. He says nothing of the reverse operation, the irregular floodings with fresh-water of salt-marshes. But what is produced by the one can scarcely fail to be as well produced in the other case. The *mode* in which the effect is produced is not attempted to be explained by the learned author quoted above; nor does any explanation seem sufficient to my mind. The rapid and abundant production of malaria may perhaps be aided, if not entirely caused, by the luxuriant cover of fresh-water plants, in the one case, being partly killed, and made ready for putrefaction, by being covered by salt water; and in the other case, in this country, by a like injurious operation on the plants peculiar to salt marshes, produced by the overflowing of fresh water. We know that certain plants flourish best in salt and wet soil, as others do in wet soil entirely free from salt; and that respectively with these different growths, the salt and the fresh marshes are heavily covered. It must follow from a sudden change in the condition, from salt to fresh, or the reverse, that the health of the entire growth must be greatly injured, and much of it subjected to death and decay.

The next most fertile source of malaria, (or perhaps what is even of greater malignity, for the small space occupied,) is presented in what is entirely the work of man—the miscalled *improvements* made by embanking and partially or entirely drying tide-marshes. The soils of these marshes, as I have ascertained by careful analyses, are composed, for about half their weight, of vegetable matter, and probably nine-tenths of their bulk is of that material, destructible by decomposition, when circumstances are favorable to that result; and drainage and cultivation produce precisely the condition which is most favorable. When covered twice every day by flood-tide, a marsh soil of this kind, though composed of the most putrescent materials, is but little subject to decomposition; because, being always thoroughly water-soaked, even when not entirely covered, and by water continually changed, the air is too much excluded, and the wetness is too much in excess, to favor the progress of decomposition. When the marsh rises so high as not to be covered by daily or frequent tides, then decomposition is more favored by the drier state of the surface, and, to a greater extent, malaria is evolved, and health injured. Hence the inference, that the higher and drier the marsh, the more it is injurious to health. But as soon as such a vegetable and putrescent soil is made nearly dry, and still more when cultivated and exposed to be penetrated by the air, decomposition proceeds under the most favorable circumstances. The soil sinks annually and rapidly, not so much by drying (as commonly supposed) as by actually rotting away; and, in a few years, it is reduced to so low a level as again necessarily to pass under the dominion and shelter of the water. The more complete the drainage, and the more perfect the management as arable or tilled land, the more rapidly is that end reached. In the progress to this end, a layer of the whole soil, of from one to three feet in thickness, will have passed off into the air in the gaseous products of putrefaction, of which enormous products, a large proportion will be malaria, and the effects produced by it on the health of some of the neighboring population are generally so evident as to leave no doubt of the source of the evil. More full details on the effects

of embankments of tide-marshes are to be found in previous articles in this work.*

The production of malaria by the last named operation, the embanking of marshes, however, is necessarily of very limited extent—and, moreover, of very limited duration. Nature soon asserts and enforces her rights; and the hopes of the improver, and the land so improved, are together overwhelmed by the reinstatement of the waters, and this source of disease is thereby cut off.

Tide-marshes, however extensive and injurious in their operation on health, still are limited to a comparatively small proportion of our broad territory. But there is another source which spreads disease over half the state, and which is entirely of artificial formation, and of which the evil effects have been becoming more and more extensive, and more and more virulent, from the early settlements of the country to this time. This widespread and generally operating source of disease and death is furnished by the numerous mill-ponds, of variable height of surface, which are now scattered over the whole face of eastern Virginia, and of which every individual case adds something to the general and enormous amount of injury to health and to life.

The law of Virginia in regard to the erection of mill-ponds, with perhaps the exception of the fence-law, is one of the most stupid, and most regardless both of private rights and general interests, of all in our code; and it is far more objectionable than the former, inasmuch as while the one merely robs individuals and destroys public wealth to an enormous amount, the mill-law permits and encourages also the destruction of health and of life throughout the whole land. It is true, unfortunately, that this opinion is not entertained by many persons; and that even with those who admit that all such mill-ponds are injurious to some extent, their estimate of the amount of evil is much below mine. It is my object to awaken the community to a sense of the enormity of the evil, and thereby to induce the commencement of measures of remedy and prevention. The universal acquiescence in this policy of our country, and the almost universal ignorance of the evils which it produces, requires strong language to enforce novel views in opposition to long established opinions. But it is confidently believed that my denunciations will be justified by reason and by facts, and by the magnitude of the existing evils.

There has long prevailed in Virginia a mania for building water-mills, which was not restrained by insufficient regular supplies of water to fill the ponds, nor by the insufficient prospect of business and of profit, even if there were no failure of water. In consequence, there have been not only erected mills on every stream barely sufficient to keep a common corn-mill in operation, but also on as many others where the water-power was either insufficient, or totally failed, during the driest season of every year. In the tide-water region, the mills for grinding wheat-flour, or any thing else for sale abroad, are limited to the falls of the rivers. All the others, (and probably there is on an average one for every square of five miles,) are merely designed to grind for toll the corn used for bread in the immediate neighborhood; and, considered merely in regard to money-cost and profit, it is most likely that half the mills in the country do not get enough toll-corn to pay for more than the costs of maintenance and repairs of their establishment. The more worthless the mill, on account of the insufficient supply of water, the more productive it necessarily is of malaria, diseases, and death. It will be difficult for me to make those who are unacquainted

* See Farmers' Register, p. 107, and 129, vol. i., and p. 41, 42, vol. v.

with our country believe that hundreds of mills have been built, and that most of them are still kept up, and many more new ones will probably yet be added to the number, which cannot yield any clear profit, above the entire cost, to the owners, independent of cost in property to the neighbors, and the cost (whatever that may be) of health and life to the country at large. Still the fact is notorious throughout lower Virginia, if it does not extend through the higher middle country. The only reason that I can conceive for so many unprofitable investments of this kind is, that many residents of the country build mills as many others raise race horses, more for amusement and excitement and to vary the monotony of their lives, than for profit. But this propensity of individuals could not have done much mischief to the country at large, but for the encouragement offered by the government. According to the law, and the long-established usage under the law, any man who desires to erect a mill, and for which it is necessary to pond the water on some of his neighbors' land, has nothing to do but to apply for an order of the county-court, by which the sheriff summons a jury to meet on the spot, to judge of and assess the damages that will be sustained by the owners of the lands designed to be covered by the pond. The jury is generally composed principally of men as ignorant and unfit for such investigations and estimates as the neighborhood can furnish—and they decide by guess as to how much land will be covered, and what damage will be sustained in the loss of the use of the land. There is no question entertained as to whether a mill is at all required by the demand of the neighbors for meal; and if the question of the effect on health is even named, it is addressed to a body entirely unacquainted with, and regardless of the whole subject. In fact the question as to health has rarely been considered in any such cases—and never duly considered. If the land that will be covered by a pond, though very rich, is then in the state of swamp, and totally unproductive, such an uninformed jury as the case is usually submitted to will be very ready to decide that such land is worth nothing; and if $3 an acre is given as damages for the land actually to be covered by the pond, it will be deemed a liberal allowance. The court will rarely refuse to sustain the verdict of the jury.

Though the use of the land thus covered is for ever taken from the owner, or, for as long as the mill-owner may choose to keep up his pond, still the right of property is not changed. This small reservation of right, or feeble homage to justice, serves as a still further injury to the community, and is not of the least value to those to whom the right is reserved. It would be far better for all parties, if, when land was thus condemned to be covered by a mill-pond, that the damages assessed, however low and contemptible compared to the damages actually sustained, should have been deemed the purchase-money of the land, and the absolute right of property vested in the mill-owner. If this were the case now, there are many mill-ponds in Virginia which would be forthwith laid dry, even though the mills should necessarily go down; because the land covered by the ponds is now known to be worth more for cultivation than the mill is for toll. Hundreds of other mills, of greater profit and value, also, in that case, would be better supplied with water by canals than by their present ponds, by which their value as mills would be increased, to the owners and to the public, and the nuisances of the ponds be equally abated. But, as the law now stands, if a mill, which will not bring in of net rent $50 a year, covers by its pond 500 acres of rich land belonging to other persons, the mill-owner has no interest whatever in draining the pond, because its drained bottom would belong to those persons. In any case approaching to this, and in which there would be a gain to all the individuals concerned, by draining the

pond, still it is not done, and the nuisance continues long after it is well known to be such, because there is a contest between the several owners of the pond and of the land covered by it, in regard to their respective shares of profit to be gained by emptying the pond. Many such cases still exist in Virginia; although many of the most unprofitable ponds, from proper views of economy, have been drained, and either substituted by cheaper and more efficient canals, or the mills put down entirely. An old mill-pond in Dinwiddie county, which covered 1200 acres of land, has been drawn off, and thereby an indifferent mill exchanged for a large fertile farm. This would not have been done, even if the mill was worthless, but for the ownership of the mill and the land covered by the pond falling into the same hands. There is a mill-pond now kept up in Prince George county, which is supposed to cover nearly 400 acres of land; and there are many others not much smaller, on different branches of swamps in lower Virginia. The larger the pond, in general, the greater proportion of bottom is left dry in autumn, and the more disease is therefore produced; and though the draining of such large ponds would be so much the more an object of gain, there is the less chance for its being done, because of the many separate ownerships and interests.

Almost all the mills throughout the lower part of Virginia, and also a large proportion of those in the more hilly middle county, are worked by streams which are inadequate to the daily supply of the mill and evaporation from the pond, even if the grinding is not necessarily suspended or diminished at any time. To guard against the temporary failure in dry weather, the full "head" of the pond, (or the level of water for which damages were assessed, and to which the water may lawfully be raised,) is much higher than the lowest level that will work the mill. The land covered is also usually very nearly level, so that to raise the water 10 or 15 feet at the dam, will often back the water from one to two miles up the low-grounds. If the variation between a full head of water, and the lowest level, be 5 feet perpendicular, it will often cause the uncovering of many acres of the bottom of the pond to the hot sun, and thereby furnish a most fruitful source of malaria in every such case. Rich alluvial mud, as this always is, thus exposed in hot weather, cannot be otherwise than very injurious to health; and there is not a pond-mill in Virginia, with a variable head, which has not more or less of the pond every summer thus converted to a fruitful seed-bed and nursery of disease.

Besides this, there is the not rare occurrence of the pond being entirely drawn off in summer, by the breaking of the dam, and its being suffered so to remain for weeks or months, before being again repaired and the pond filled. In this case, a double quantity of bottom is exposed to putrefaction, and fitted for the discharge of unhealthy miasma.

At all times, in ponds supplied by streams as feeble as most of those used for mills in Virginia, the water approaches to a stagnant state; and therefore of itself is a producer of malaria. In dry seasons, when unusually low, the putridity of the water of such ponds is perceptible to the sense of smell; and it must be then far from harmless.

Another, and in certain situations, the greatest evil of mill-ponds, remains to be stated. The others above-mentioned are the effects of the scarcity of the supply of water; this is from the excess, which is found in all streams, at some times, even though the most deficient at others.

To guard as much as possible against the expected scarcity of water, the mill-owner aims to hold, when rains increase the usual supply, as "full a head" as he has a right to maintain. When this supply is exceeded, as it frequently is, and greatly, if the dam be not actually broken, and the whole

emptied, in one prodigious flood, at least the flood-gates are opened widely, and a discharge made ten-fold greater than would have occurred during equal time, if the stream had not been obstructed by a dam, and had discharged as regularly as the supply was increased. It will be evident, on considering these circumstances, that water from a mill-pond, whether discharged by flood-gates, or otherwise, must be far more variable in height, and in extent of inundation on the land below, than the natural stream unobstructed by art; and still more than the stream opened and improved and its course facilitated by art. An ordinary natural stream, which might have a very uniform discharge in dry weather, and would rarely overflow its banks in wet, if dammed across for a mill, would often have its bed below the dam left almost dry; and, at rare and irregular times, would be converted to a tremendous flood, which would sweep over hundreds of acres more than the floods of the natural stream could have reached. Besides the immense damage caused to cultivated land by these floods, (and which kind of damage is rarely estimated or thought of by juries when mills are established above,) there are numerous hollows made, and filled with water, which, on the retreat of the flood, (as hasty as its inroad,) remain so many stagnant pools until made dry by evaporation. The whole land, thus covered, is saturated with water; and, from the nature of the rich alluvial soil, is throughout, as it dries, made a producer of malaria.

But the worst part of this evil, by far, is when these artificial floods of fresh-waters pass over salt-marshes—which happens in all the country in which the fresh and salt waters meet; and this combination of causes I consider the most efficient producer of disease in that part of the country, and the thing which ought most especially to be guarded against. According to the views before presented, the passage of fresh water over salt-marshes, no matter to what extent, is one of the most sure producers of malaria, and of a particularly malignant kind. The mill-ponds, alone, form other and far more extensive, if weaker sources of the poison; and by the union of the two, the mill-ponds exert all their usual bad influence above the dams, and spread ten-fold more pestilential effects below, by inundating the wide salt-marshes, which by natural streams would scarcely have been affected.

On Nansemond river there are lands already rich, and having inexhaustible supplies of the best marl, which have been sold at $10 the acre. There are hundreds of estates in the same belt of country which cannot be sold for as much as the cost and present value of the buildings. And this otherwise fine country, so accursed by disease, owes its condition principally to the mill streams which flow into the salt tide-waters, and which are so numerous, and their sources so interlocked, that there is no spot safe, by remoteness of position, from these combined effects of mill-ponds and salt-marshes. It is therefore sufficiently evident why that otherwise finest part of the state, for agricultural improvement and profit, should stand among the lowest in both these respects. Yet this part of Virginia might be rendered both healthful and fruitful, and the delightful region which God has permitted it to be made, if man would accept and avail of his bounties by merely using half the expense for improving which has been lavished to inflict pestilence and poverty on the country.

These statements and expressions of opinion will be unpalatable, if not offensive; and perhaps may subject the writer to the charge of being willing to injure the residents of the region for whose relief in this respect he is most anxious, and of the facility and cheapness of obtaining relief, by the use of proper means, he feels most confident. If the exposure and probing of the ulcer be never so painful, let it be remembered that it is done solely for the purpose of seeking for, and applying, a sure remedy.

There is still another source of malaria, which it is necessary to touch on in connexion with the above-mentioned, though it has been already treated more fully elsewhere, and therefore will be but slightly mentioned here.*

From the vegetable matter upon the driest land, as it ferments and decays, there must be extricated more or less of the gaseous matter which, when in excess, is injurious to health. According to this view, the whole surface of the country, and especially that most heavily covered with vegetable matter, may furnish malaria. The degree of hurtfulness of this product will depend on the power of growing vegetables to feed on, and of the soil to absorb and fix in it this matter, which, according to its direction and quantity, may either enrich land, feed plants, or poison men. In earlier publications I have stated at large my reasons for believing that all the products of vegetable decomposition, on naturally poor lands, are lost to the land;† and as the ultimate results of decomposition are gaseous, or aëriform, they must go off into the air. These products constitute or cause malaria, and its injurious effects on the health of the inhabitants. But calcareous matter serves effectually to fix in the soil the enriching principles of decaying vegetable matter, until they serve as food for growing plants. Hence the deduction that a naturally poor soil, made calcareous, will no longer throw off gaseous products, or malaria, into the air; but will store it up as fertilizing manure. The sure remedy for the irregular and generally slight degree of sickliness thus caused, is to marl or lime all the land that requires calcareous earth. But that remedy would not be sufficient, if mill-ponds or marshes in the neighborhood continued to send out large additional supplies of the aëriform poison.†

The correctness of my deductions as to the very injurious effects of mill-ponds on health, will be denied on several grounds, which, so far as expected, I will anticipate as objections, and state with the answers, as follows:

Objection 1.—Admitting generally, and to some extent, the ill effects of mill-ponds in producing noxious exhalations and autumnal diseases, it does not appear that these effects can be either so great, or so sure, as is charged above. The residents on the farms nearest to mill-ponds are not always, and often not at all, more sickly than those who reside several miles distant. The house of the slave who acts as miller, is usually near the mill, and close to the pond; yet families so situated are generally as healthy as any others, and sometimes are healthy in a remarkable degree, compared to the neighborhood generally.

Answer. Near the mill-dam, or the lower end of the pond, may well be less affected by the exhalations from it, than places a mile or two more distant. That part is the deepest of the pond, and of which also the banks are steepest; and perhaps half a mile in length of the bottom of the upper and shallowest part of the pond, and of alluvial mud, might be left naked in drought, before a margin of steep hill-side of three feet width could be exposed near the mill. Further—from the greater lightness of the malaria, it will rise high in the air, and would soon be carried far away by a moderate breeze. If the wind be moderate, and steady to one direction, and still more if its course be confined to an opening by or between woods, or to a narrow valley between high hills, it may well be imagined that the poisonous air might injuriously affect persons perhaps five miles from the pond, and who would not suspect the operation of so distant a source;

* See 'Essay on Calcareous Manures,' 3d ed., chapter xv, and 'Essay on the Police of Health" commencing p. 154., vol. v., of Farmers' Register.

† Essay on Calc. Man., pp. 23, 57 and 89.

while others, close to its border, but in a different direction, or on a different level, might escape its influence.

Objection 2.—There is not enough difference in the usual or average healthiness of families the most exposed, and others the least exposed to mill-ponds, to attribute much of the effects to these causes. Whole neighborhoods, in some autumns, are very healthy, and in others very sickly, without either condition seeming to be connected with any certain and known state of the nearest mill-ponds.

Answer.—The extreme lightness of the poisonous air, and great and frequent variations in the direction, force, and continuance of the winds on which it is borne, make it generally impossible for it to be known from which particular pond or ponds the malaria rises, or where it is carried. It is most probable that the exhalations of twenty ponds, of which the most remote may be thirty miles apart, may be mingled together by the winds of a single day, and thus combine and average the effects of all. Further, if all the mill-ponds of a county furnish one half of the active and injurious malaria, and the other half is thrown off, nearly equally, by the whole surface of the land, (though some parts would receive the strongest doses, and others escape with having only the weakest,) it would be impossible to understand the mode, and estimate the intensity of operation of the known general causes; or to refer, with certainty, any one effect to its special or principal cause. Thus, a farm relieved from all malaria of its own product, by marling and by drying its mill-pond, though evidently showing the benefit in increased general healthiness, might still be sorely visited by the seeds of disease from other and remote sources, directed and concentrated by a steady wind.

Having presented these views of the origin, action and effects of malaria in this country, I can better exhibit the progress of the causes which I believe to have operated, and which are still continuing to operate, to produce the change from a healthy to an unhealthy state.

When our ancestors first reached this shore, nearly the whole country was in a state of nature. The savages had cleared for cultivation but a few fertile spots on the banks of the rivers; all the remainder of the land was under one great forest. The streams had not been obstructed by the cutting down of trees across their beds, (by which in many cases streams have since been choked, and swamps thereby formed, or greatly extended.) No dams had obstructed the free and regular course of the streams, and therefore no great artificial floods were formed. The soil not having been cultivated, was not exposed to be washed away by the rains into the rivers. The waters therefore were generally clear, instead of being generally muddy, as since all these circumstances have been changed. In this former state of things there could have been existing but few sources of malaria.

The first formation of sources by the civilized settlers, was in making ponds to supply mills. But while these were yet few in number, the constructers of course chose the best and most unfailing streams; and the ponds were also, for a long time, surrounded by dense and tall forests. Such hilly land as the margins of the ponds would certainly not be brought into cultivation while so much that was far better, and easier to till, remained unoccupied. Hence, such ponds produced but little malaria, and that little was warded off from the settlers, or taken up by the forest growth. The general wooded state of the country, also, for a long time, rendered the supplies of water more regular, and prevented the severe droughts, which would have altered greatly, as is usual now, the levels of the ponds.

The clearing, cultivation, and consequent washing of the lands of the upper country, greatly increased the muddiness, and quantity of alluvial

deposite of the rivers, and thereby increased the marshes both in breadth and in height. More mills continued to be built, and on streams worse and worse for water power, as the choice became less open, and the mill-mania began to grow; and, in the general, each successive construction of a pond was less productive of profit, and more productive of disease, than its predecessors. The number of mills not only continued to increase, and is increasing to this day, and in the oldest settled parts of this state, as well as the newest, but gradual changes also took place in the condition of the old mills which greatly increased their fitness to produce disease. By the long continued deposite of mud from the streams, and the washing of the now cleared and tilled hill-sides, the ponds became more shallow, and the waste of water by evaporation therefore became greater; while the supply was lessened, in consequence of the extended clearings of the great forest which had before covered the whole country. To remedy the increasing deficiency of water, the owners of old mills, who were not prohibited by circumstances, raised the level of their ponds; which, by increasing their surface and their contents, still more increased the daily evaporation, and also the violence of floods, and the variable height and surface of the water; all of which again combined to increase, still more than before, the product of malaria. The consideration of the progress of all these circumstances, and their bearing on each other, will serve to explain why a particular neighborhood might formerly have been healthy, though having two or three mill-ponds within or around it; and why it might gradually have become very unhealthy, in the course of time, by the malaria produced by the ponds of the same mills, or perhaps by the addition of one more pond only to the former number. But, in such cases, so gradual would be the general change, and so irregular and variable the attacks and virulence of the autumnal diseases, that the sufferers would not attribute the change, (even if they admitted it to have taken place,) in their average degree of health, to causes which had so long existed without being charged with doing mischief; and in which causes no change of condition had been observed. Add to this, that self-love makes every man reluctant to believe, and to confess, that his own farm, or his own neighborhood, has become more sickly; and the change for the worse is attributed to transient causes, until the former state of things is almost forgotten, and the present is received as if it had always been the usual condition of circumstances.

During all this time, other causes were working to produce other nurseries of disease, and impediments to agricultural products and improvement. The wet alluvial bottom-lands, bordering on small rivers and still smaller streams, were for a long time neglected, and deemed of little value, except for their fine white-oak, cypress, and other noble timber trees. These were cut down so as to fall into or across the streams, when in reach, more often than otherwise; and in consequence of such obstructions, continually increased in number for more than a century, the before open streams were choked, and the bordering low-grounds converted to swamps; and those which had been swampy at first were made still more so, by obstructing the sluggish streams, and spreading them over the whole surface, and causing that surface continually to rise by fallen trees and alluvium. But wet as are such swamps for the greater part of the year, most of the surface is dry in autumn; and the scanty water is then stagnant in numerous pools, until added to by the first heavy rain, or a flood from a mill-pond discharged above. Of course all these circumstances added enormously to the previous annual decomposition of vegetable matter, and consequent production of malaria. Such swamps as these, formed by nature and increased by art, are those on the Chickahominy, Blackwater, and many other long but

gentle streams. To form or increase their evil qualities and tendencies, the law has given full permission, and no small aid; but it positively, though indirectly, *forbids the drainage* of all such extensive swamps, and preserves them still as mere nurseries of disease. A general law for permitting and facilitating, under proper regulations, the draining of these great swamps, would be a measure which would be most beneficial, not only for improving the healthiness, but for increasing the agricultural products of the country.

But though the tendency of the general changes in the physical condition of the country was to increase the causes of autumnal diseases, there were numerous particular exceptions, in works serving to promote health. Of this kind were the opening and straightening of the choked channels of small rivers, and many large streams, in the hilly country, where there was enough descent to enable each individual proprietor of flooded low-ground to relieve it by operations confined to his own land. The effectual drainage of much land of this kind has produced so much benefit to health as in many cases to balance and even exceed the increasing pestiferous effects of the neighboring mill-ponds. Such facts would be taken by most persons as proofs that the increase of mill-ponds had not increased disease. Such benefits have been produced by the gradual draining of the extensive low-ground of Gloucester, which in its former and natural swampy state must necessarily have been an abundant source of malaria. This change, together with other circumstances stated in the recent description of that part of the country, has operated to render the Gloucester as free from bilious disorders as any part of the tide-water region—save the adjoining county of Matthews.* The remarkable general state of healthiness of all these very low lands at present, as well as the exceptions and evident causes of the exceptions, furnish the most clear and important evidence of the truth of the position, that mill-ponds and floods of fresh-water discharged over salt-marshes are the great sources of malaria in Virginia. As stated formerly,† there are but few fresh-water streams discharged on salt-marshes in these two counties, and not a pond-mill on the low-grounds, nor indeed in the whole county of Matthews, save one on its border nearest the high-land. The facts presented here alone will prove the great and certain benefit to be obtained by even a partial and imperfect avoidance of the action, separate and combined, of these two greatest sources of malaria.

But although the general and average degree of sickness may have been, and certainly is, much lessened of late years by the better drainage of very many of the smaller swamps—the introduction and increase of more perfect tillage, which includes better drainage of arable land—and, still more by far, by the now extensive applications of marl and lime—yet it would be a great and dangerous error thence to infer that the mill-ponds and the still remaining irreclaimable swamps had become less injurious to health. Their malignant effects are not only not lessened in the slightest degree, but must continue to increase with time, as long as the present destructive legal policy of Virginia remains. The growing beneficial operation of the other and opposite influences, have indeed served to neutralize, counteract, and even (in the most thoroughly marled districts) to greatly overbalance the continually increasing disease-producing operation of the mill-ponds and swamps; but not to prevent its existence or power. The greatly beneficial operation of calcareous manures especially in improving health, (which operation has been so fully treated of in preceding parts of this work as

* See the facts and reasons stated more fully at p. 179 and 190, in vol. vi. of Farmers' Register.

† The same p. 190.

to be unnecessary to enlarge more upon here—) instead of blinding us to the unabated though more concealed effects of remaining sources of malaria, should urge the more strongly, and encourage every effort, to destroy all such sources. For if the mere counteraction of opposite influences has so much improved the healthiness of a large portion of lower Virginia, it may be safely inferred, that the removal of the remaining sources of disease, and leaving the beneficial influences to operate freely and absolutely, instead of merely by counteraction, would serve to make this region as healthy, in general, as any part of our whole country.*

The most important part of this subject is the consideration of the remedies for the evils described. But although the means available for this end in my opinion are ready, cheap, and sure, still it is needless at present to argue in their favor at great length. Unless the people are aroused to a proper sense of the evils under which the country suffers, no regard will be paid to the consideration of proper remedies; and if the former object can be gained, the latter will then necessarily follow.

The most important of these remedies, and of which the proper use, I maintain, will remove nearly all the existing sources of malaria, and make lower and middle Virginia healthy, will be merely here stated concisely and distinctly.

1st. To prevent the continuance of any mill-ponds of very uncertain supply, and variable "head," or height of water.

2d. To furnish to the land-floods, of streams swollen by rains or by any mill-ponds still left, the quickest and best possible discharge to tide-water by open canals, so as to prevent the fresh-waters passing over any salt-marshes.

3d. To drain the great flat swamps; all of which require a continued canal to be extended from the lowest out-let up to the head of the supply of water, in the most effective course, and on a general plan, through the lands of many different proprietors. The drainage of lands so situated is effectually forbidden by the existing laws; as there is no power to act, unless all the proprietors concur in every particular of the execution and expense of the drainage; which is obviously impossible.

4th. To refrain from embanking from the tide any marshes of the usual putrescent and perishable soil.

5th. To apply marl or lime to all lands needing calcareous manures, and on which they can be furnished at not too great cost for even such great improvement of soil and product as would certainly be obtained in all such cases.

The two last means of prevention are altogether within the power of individuals, and will be used, or not, according to the views of different individuals as to the agricultural profit to be expected from such operations.

The three first-named means of remedy would each require the action of the legislature, to enable them to be used to any considerable extent.

The necessity for a general plan being authorized by law for inducing and compelling combined operations to drain swamps on long and sluggish streams, though merely for agricultural improvement and profit, is already evident to most intelligent farmers; and perhaps nothing is now wanting to procure such legislation but the proper exertion of some of the individuals who are most interested on the subject.†

The giving free vent to land-floods, also, by wide and straight canals, and

* This paragraph is an addition to this article, as it was first published in 1838. The only other changes made, are the correction of a few verbal inaccuracies, and the marks of references to this Essay being made to suit the present instead of the previous edition

† See Farmers' Register, vol. i., pp. 232, 386, 518, 733, 734.

preventing them, by dikes, from overflowing the salt-marshes, though a kind of work requiring public money as well as legal authority, still may be hoped for, when the necessity of the measure shall have been made evident.

But there is no such prospect of success as to the most important reform needed, in the putting down of all fever-breeding mill-ponds; and he who will venture to advocate this general measure will be regarded, by most of those whom he aims to serve, as more an enemy than a friend to their interests, and more deserving to be treated as a lunatic, than to be respected as a judicious advocate for valuable public improvements. It is not in the vain hope of now enforcing my views by extended argument, but to offer explanations, and thereby prevent misconstruction, on some particular points, that some further remarks will now be offered.

Even if the public mind had been prepared for a full legal reformation of the policy of mill-ponds, and for the laying dry all such as are nuisances to health, there would be no accompanying necessity for injuring the private interests of mill-owners, nor of causing material loss or inconvenience to the customers of the mills. In the first place, in justice to the vested rights of the millers, (however unjust to others, and injurious to the public may have been the original creation of their rights,) I would advocate full compensation being made for every sacrifice of value in their ponds, which should be required and compelled for the general benefit. But *not more* than full compensation for all value thus destroyed should be granted; and many of the fever-breeding ponds are really of no pecuniary value to their owners or to the public; and most others may, to greater advantage, be supplied with water by canals, instead of by ponds. Even if one-third of all the mills should be thus put down entirely, these would be such as now always fail in dry seasons; and the more permanent and regular supplies of water, which all the remaining mills would receive from the canals substituted for ponds, would render them able to furnish the whole country with meal, with regularity, certainty, and in abundance, and therefore more suitably and conveniently to the consumers, than all the mills, good and bad, now in operation. By an important innovation in the law in regard to mills, (enacted March 2d, 1826,) every owner of a mill is authorized to cut a canal through the lands of other persons, if required by the nature of the locality, so as to substitute the pond by a canal. Before this amendment of the old law, no mill-owner could effect any such improvement, unless in the rare case of his own land extending under the whole course of the desired canal. The privileges offered by this new provision have already been availed of in many cases, in Charlotte and the neighboring counties, and to great advantage in regard to health as well as to increased power to the mills, and with great value gained in the rich drained bottoms of the ponds being put under cultivation. Slowly as such lessons are usually learned, and slowly as new agricultural improvements are brought into extended use, this highly beneficial and profitable improvement cannot fail to be adopted generally in the course of time.* The main obstacle to the early and general substitution of canals for ponds, wherever the change is practicable, is the absurd legal distribution of rights in the mill-ponds and the land which they cover, as stated on a preceding page; one person being vested with the perpetual right to keep the land overflowed and worthless, while others have the right of property in that land, to be exercised only in the never-expected event of the owner of the pond drawing it off and draining the rich bottom, and that for the gain of others more than himself. Now I

* See facts and statements on this subject at p. 231, vol. v., Farmers' Register, pp. 1 to 3.; p. 579, vol. ii.; p. 374, vol. iv.

would get rid of this absurd conflict of rights, by vesting the full property of the land covered in every mill-owner who would draw off the pond; or if he did not avail of the privilege offered, the land should be given up to its former owners, or to any one else, who would construct a canal, and thereby secure to the use of the mill an equally good supply of water-power.

Each of the several remedies proposed and stated above would alone furnish a fruitful subject for investigation and discussion. But more extended remark from this source is as yet uncalled for. Other persons, having better practical information, and thereby prepared to confirm or to disprove the positions here assumed, are invited to aid in the discussion. Let the truth be made known, on whichever side it may be found; and should all facts and deductions presented serve to show that the present system greatly needs reformation, and to awaken the public to the importance of the object, then will be the suitable and propitious time to ask attention to remedies proposed for the then acknowledged evils, inflicted by the action or permission of the government. Whenever the legislature is prepared to act decisively on this whole question, there will be before them a subject for the "internal improvement" of Virginia far more important in beneficial results than the roads and canals which have cost millions of dollars to the treasury; and yet which will be cheaper, compared to the profit to be certainly counted on, than the most humble or contemptible job for private objects, which has yet been carried through by public expenditure, and as a public improvement.

But even under the existing law, any single individual who clearly sustains injury to health from any particular mill-pond, has now the legal power to have that particular nuisance abated, by means of suit for damages for the injury thereby sustained. It has been judicially settled that such ground of suit for damages is not prevented by any previous assessment by the first jury, nor by any lapse of time during which the mill has been standing; nor is the ground removed by the new damages awarded for injury already sustained and sued for. No matter how often damages may have been given to the plaintiff by successive verdicts, and paid by the defendant, there will continue ground to sue, and recover, as long as the pond remains, and is hurtful. It is surprising that the law, so favorable to the interests of mill-owners, and regardless of all conflicting interests and rights of other persons, should have permitted, in this particular, so much of remedy for the previous injustice and injury inflicted by the law. And it is still more surprising after legal decisions have so clearly shown the remedy, that, of so many thousands of individuals who are unquestionably suffering every autumn from the neighborhood of stagnant mill-ponds, so few should have availed themselves of the offered means of relief.

If the importance of this general subject were duly appreciated, its investigation would become an object of the care, and be conducted at the expense of government. If the legislature of Virginia (for example) would institute a "General Board of Health," or "Commission of Sanitary Police," for the purpose of investigating the subject of malaria thoroughly, and of reporting the sources and proper remedies, the body of evidence which would be collected, and the after-results, might be made worth many millions of increased pecuniary value to the state, besides the far greater benefit to be produced to the health, the physical and moral qualities, and the general happiness of the people. At any possible cost of such an investigation, and of the system of measures founded thereon, the public improvement and benefit produced thereby would exceed the expenses a hundred-fold.

Note X.—Extension of subject from page 150.

A MACHINE PROPOSED FOR RAISING MARL.

The machine which will be described below is used at Fortress Monroe for raising sand from the fosse to fill the ramparts; and has been found by experience to be the best contrivance of all which have been tried for that operation, and for which an immense amount of labor was necessary in constructing the defences of the fortress. Precisely the same manner of operation is required for raising marl from deep pits, and there can be no doubt of this being a more effective machine for that purpose than any heretofore applied. The force applied is the weight of the laborers, on the principle of the tread-mill, which is the most effective manner in which the power of men can be applied. I am indebted for the suggestion of this machine for raising marl to the observation and scientific knowledge of mechanics of my friend M. Tuomey, and also for the following description and the drawings for the engraved figures. Mr. Tuomey, when making a transient visit to the fortress, had seen the machine at work; and recently, after reading in the foregoing part of this work the remarks on the different modes of raising marl, and having witnessed some of the usual modes in practice, this machine and what he had seen of its power appeared greatly superior, whenever circumstances may require any use of machinery. Upon being thus informed, I applied to Dr. Robert Archer, U. S. A. Surgeon at Fortress Monroe, (to whom I, and through me the agricultural public, have been frequently and much indebted,) for a rough plan, and accurate statement of the dimensions of the machine, both of which he kindly furnished; and with the aid of these, Mr. Tuomey has been enabled to give such particular description and correct delineation as will serve for full instruction for the building and working of the machine.

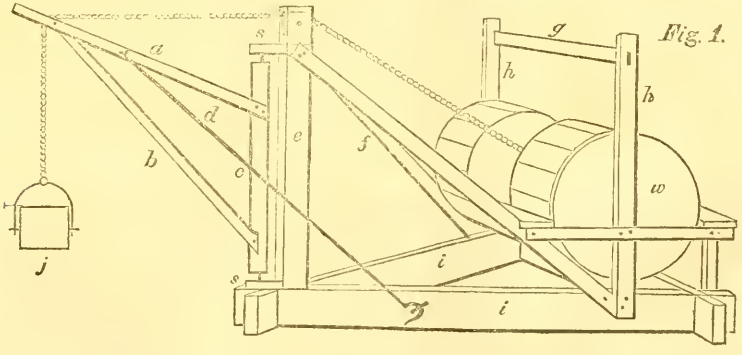

Fig. 1.

"1. Figure 1 is a side view, in perspective.

i, i, The base, consisting of 3 pieces of scantling, each 12 feet long, and 11 inches by 5, notched on to each other about 6 inches from the end, so as to be flush on top, forming an equilateral triangle.

e, The principal post 8 feet, 8 by 6 inches, secured to the base, and braced by the braces *f.* Near the top of this post 2 iron sheeves or pulleys are placed, one on each side, and secured by pieces spiked over them. The chains pass over these pulleys.

f, 2 braces 11 feet long, 4 inches by 6.

h, h, Two uprights, in which the gudgeons of the wheel turn, they are bolted to the base and connected at top by the piece *g,* 10 feet 6 inches long, 4½ by 6 inches, which also serves as a hand-rail for the men to steady by when working on the wheel. These

uprights are further secured by cross pieces connected with the braces, and bearing in front and rear of the wheel two steps on which the men stand as they go on or off the wheel.

w. The wheel 4 feet in diameter, the steps 3½ feet long 8 inches wide, made of 1½ inch plank. The ends of the wheels are formed of two thicknesses of inch plank placed crosswise, the inside being grooved to receive the steps which are placed about 8 inches apart. The axle of the wheel is 10 feet 6 inches long and 8 inches in diameter, the portion around which the chain winds is enlarged, so as to suit the force employed on the wheel, or the weight to be raised, by nailing on strips of plank, over which a few turns of old rope may be placed to prevent the slipping of the chain.

To prevent confusion, only one crane (or arm) is represented in this figure.

The crane post is represented as turning on two iron pivots in pieces *s*, *s*, one bolted to the principal post *e*, and the other spiked to the base. The crane post is 6 inches square.

a. The crane jib, 7 feet 6 inches long 6 by 7 inches.

b. The strut to the jib, 8 feet 6 inches long 4 by 6 inches. Near the extremity of the jib an iron sheeve is fixed over which the chain passes.

c. Is a three-quarter inch rod of iron secured to *a* by means of a staple, and having a hook at the other end which drops into a staple at *i*. This rod serves the double purpose of a stay and a guide, by which (when unhooked) the arm is drawn to one side for the purpose of landing the box. When fixed, as represented in the drawing, it serves to retain the crane in its proper position. When the box is raised the rod is unhooked, and by means of it the box is landed.

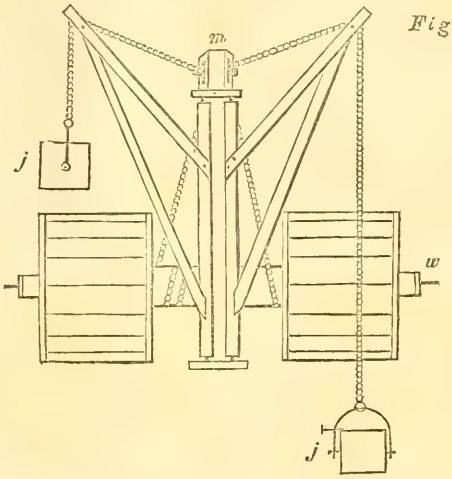

Fig 2

Figure 2 is a front view, showing the relative position of the cranes, which are represented as turned aside. The chain is seen winding around the axle. It is evident that the men must pass to the opposite side of the wheel as each box is drawn up.

j, *j*. Represent 2 views of the boxes, which are square and may be each about 21 inches every way, they will then contain nearly 6 cubic feet each. They are suspended by two pins placed a little below and to one side of the centre so as to turn over and empty themselves when a small iron pin seen at *j*, figure 2, is withdrawn. Three men can be employed to advantage at the wheel, two remaining on whilst the third gets off to land the box. Should the box not be heavy enough the diameter of the axle can be enlarged so as to make up in time what is lost in weight. Should it be too heavy for the force employed the diameter may be lessened."

The above dimensions of timbers were those of the particular machine measured by Dr. Archer; but they vary in all the machines of this kind used at the fortress. The length of the arms of course should be proportioned to the height to which the loaded buckets are to be raised. For marl, any sized timbers on hand, or logs, that are long enough, would serve for the base (*i*, *i*.) It is however desirable that the machine should be as

light as is consistent with strength, for the greater facility of moving it; and for strength alone, (as in all other machines,) the large size of timbers is of less importance than their being well put together. Two thick and narrow planks, firmly spiked together, and with a space left between of proper size for the sheeve to play in at the upper end, would be a cheaper substitute for the jib *a*. When carts are removing the marl at the same time it is raised, there would be much advantage gained in having the boxes of such size as to be emptied into the carts, and the measure or load of both being made the same.

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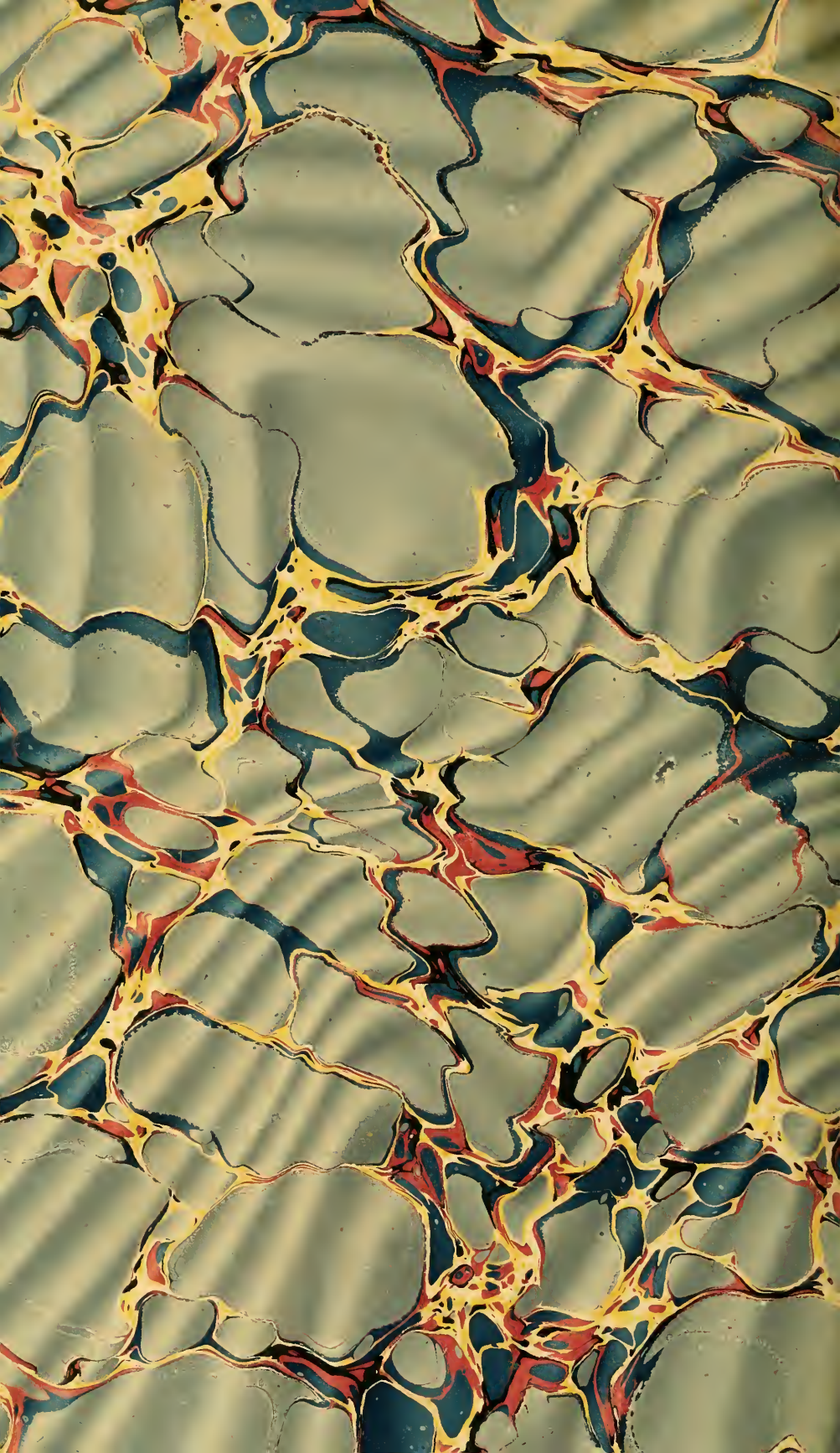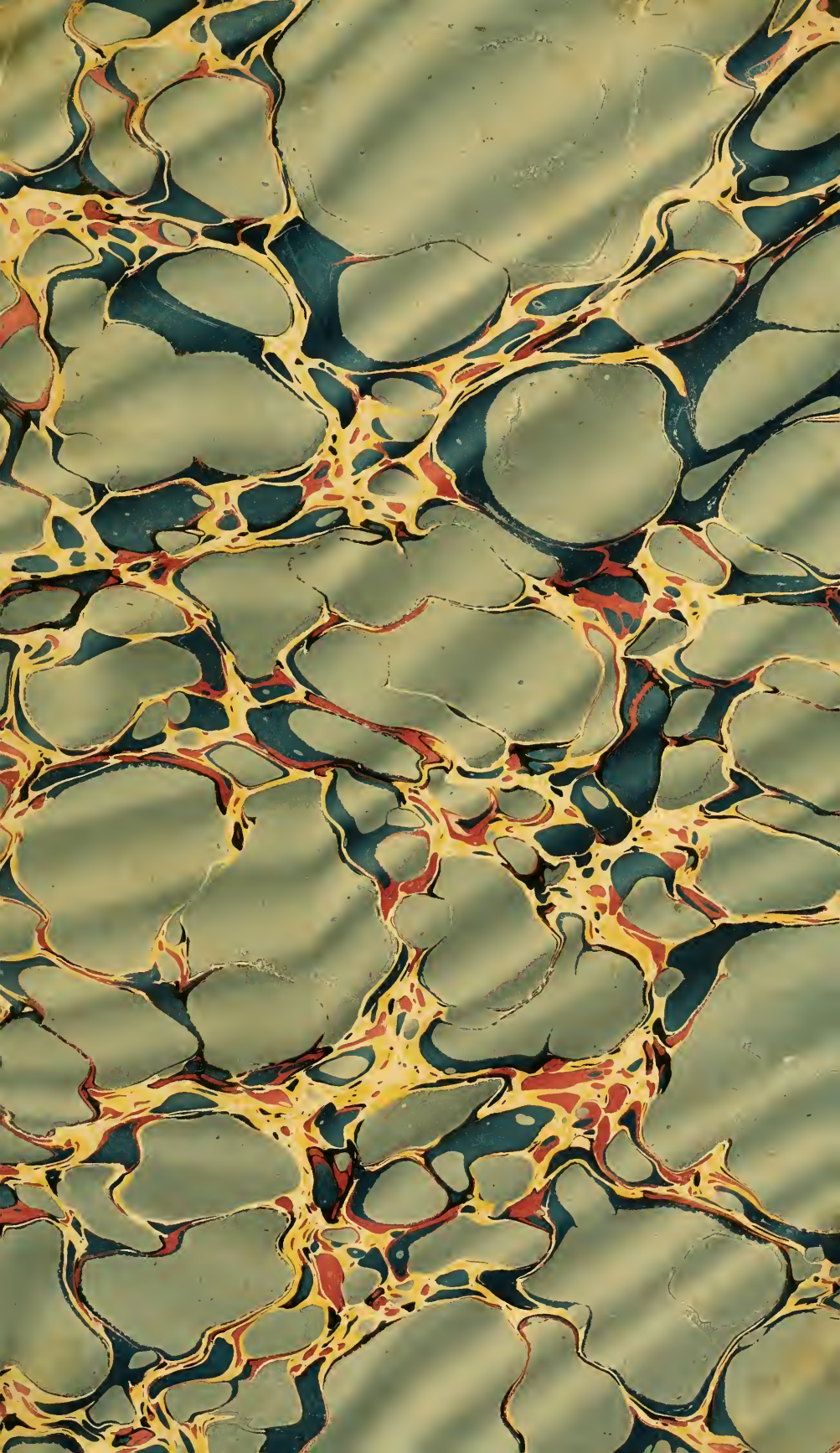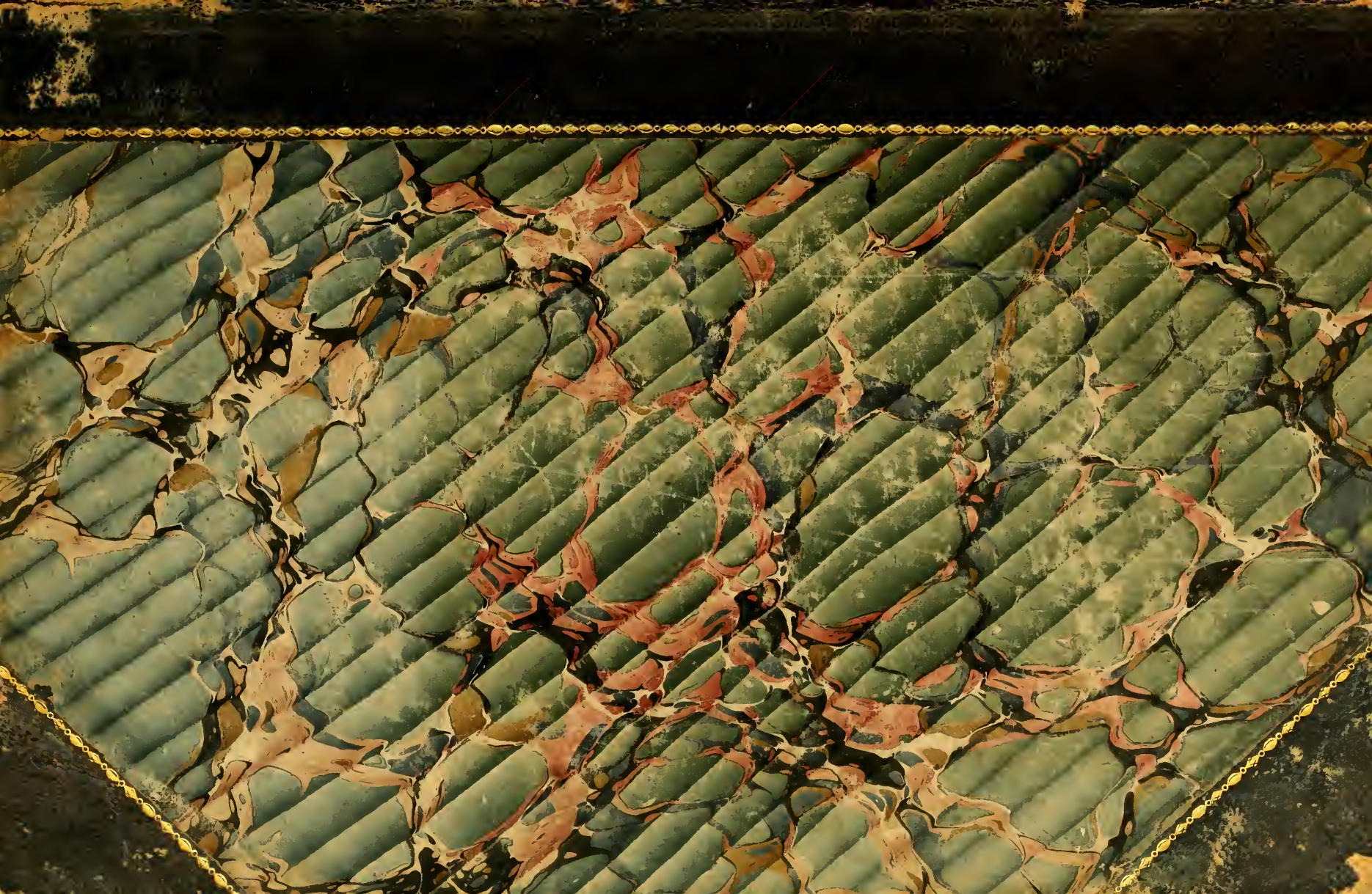
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